

APRIL 1, 1961

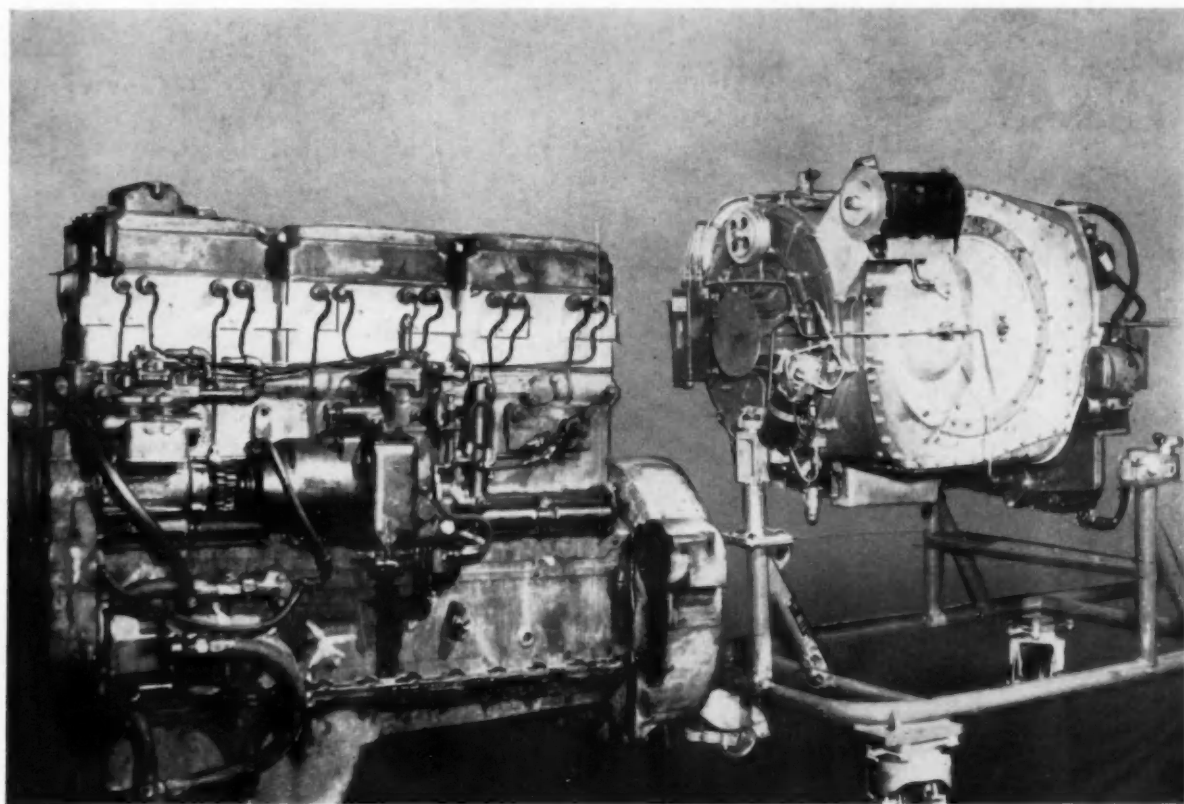
AUTOMOTIVE INDUSTRIES

ENGINEERING • MANAGEMENT • PRODUCTION • DESIGN

A CHILTON PUBLICATION

I. H. NEW PLANT

... Assembling Large and Small Vehicles ... Page 35



Above:—Allison GMT-305 gas turbine engine contrasted with 275 hp diesel. Used in (60) sixty-ton gross weight ore hauler by International Nickel Co. at Copper Cliff, Ontario, Canada, it hauls up to 34 tons of nickel ore up a continuous 8 per cent grade about two miles long.

ALSO IN THIS ISSUE . . .

PUSH ROD COVER FABRICATION

GAS TURBINES: III—Passenger Car Problems

DEERE'S REDESIGNED ENGINE PLANT

if you can't tolerate seizing and galling

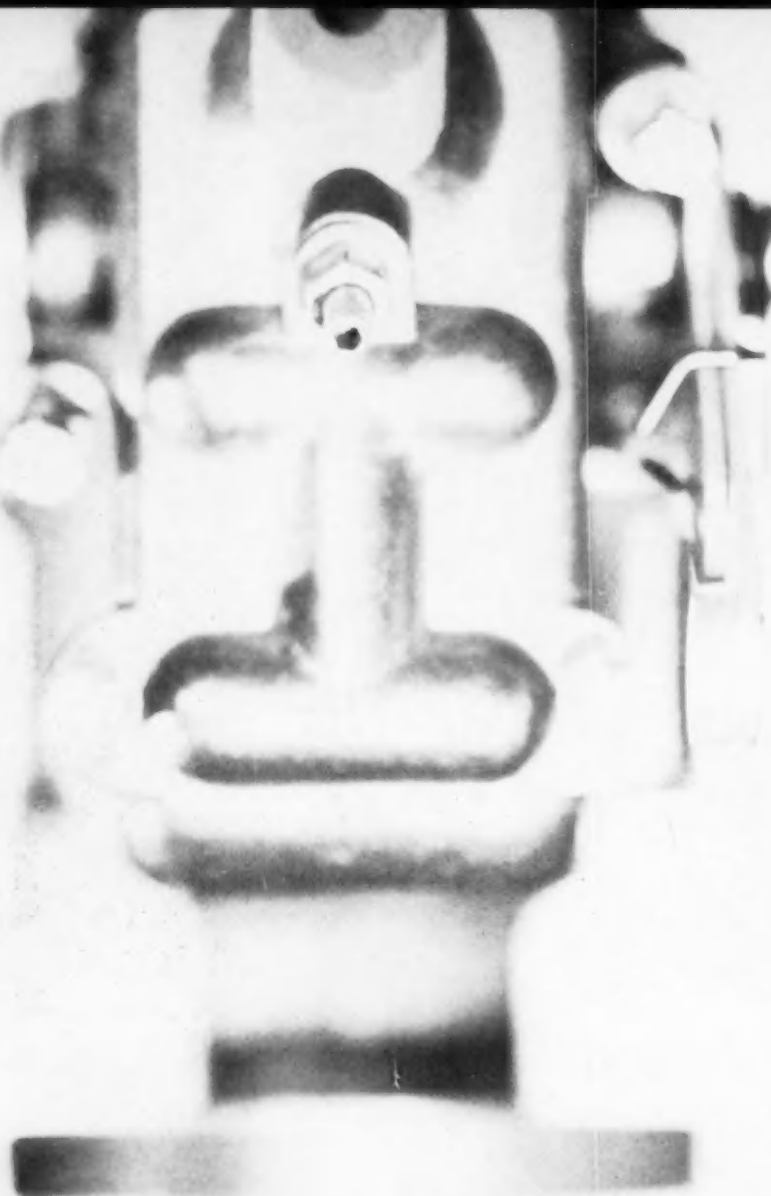
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HARTFORD REPORTS lead-treated Nitalloy machines faster, easier, actually costs less than unleaded alloys previously used.

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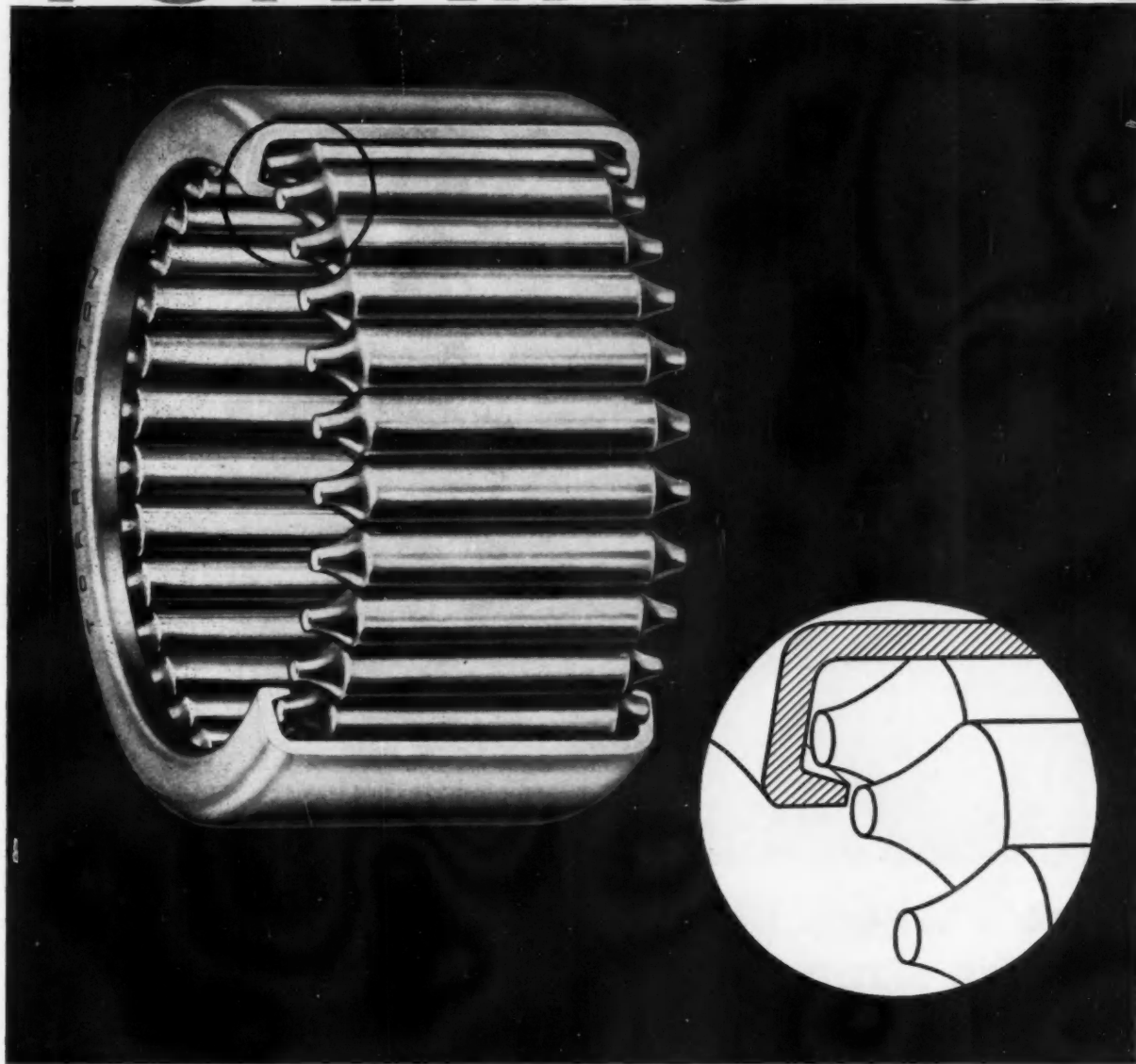
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When this beauty roars out of the quarry with 27 tons of rock on its back, you can be sure its gears and shafts encounter brutal shock-loads and torsional stresses.

International Harvester engineers anticipated this rugged service at the design stage, took logical steps to give the "Payhauler" extra stamina:


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differential pinions and side gears, transmission shafts, and integral axle and sun gear.

When you design, order, or use heavily stressed components of trucks or construction equipment, remember that nickel alloy steels take the tough jobs in stride. The new 76-page booklet, "Nickel Alloy Steels... in Engineering Construction Machinery" is packed with valuable engineering information. Write for a free copy. ®Reg. T.M., International Harvester Co.

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

APRIL 1, 1961

Passenger Cars • Trucks • Buses • Aircraft • Tractors
• Engines • Bodies • Trailers • Road Machinery •
Farm Machinery • Parts and Components • Accessories
• Production and Processing Equipment •
Design • Production • Engineering • Management

VOL. 124 No. 7

Features • • •

▼ International Harvester's New Assembly Plant

The largest and the smallest vehicles in the International Harvester line are built side-by-side in the new assembly building in Fort Wayne. The new setup is described and illustrated in a four-page article.

Page 35

▼ Automotive Gas Turbines

In the final part of a three-part article the author sums up the advantages and disadvantages of the gas turbine for automobiles. He concludes that cost and safety will be the factors which will decide the turbine's future.

Page 39

▼ Deere's Waterloo Works Redesigns Plant Facilities Part I

Production facilities at Deere's Waterloo Tractor Works have been redesigned to handle four- and six-cylinder power plants. This included purchase of 465 new machine tools and rearrangement of basic flow of materials through the plant.

Page 41

▼ Mechanized Push Rod Cover Fabrication

Tubular push rod covers for Chevrolet Corvair engines are among the new products being made on a semi-automatic basis by Rochester Products Division, General Motors Corp.

Page 44

▼ Plastics in the Automotive Industries Part I . . . Nylon

Originally researched and developed by du Pont's W. H. Carothers, nylon now finds a wide variety of uses in the automotive industry. Various types of nylon, and some of the applications are described.

Page 47

▼ Auxiliary Propelled Howitzer Has Hydrostatic Drive

The auxiliary propelled 155mm howitzer carriage, M1A2, has two engines, each driving a wheel through reduction gears, a variable-displacement pump, and a variable-displacement hydraulic motor.

Page 53

▼ 16 New Product Items and Other Features Such as:

News of the Machinery Industry; Industry Statistics; and News of the Automotive and Aviation Industry.

. . . continued on next page

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SOCIETY OF BUSINESS EDITORS

BPA Business Publications Audit of Circulation

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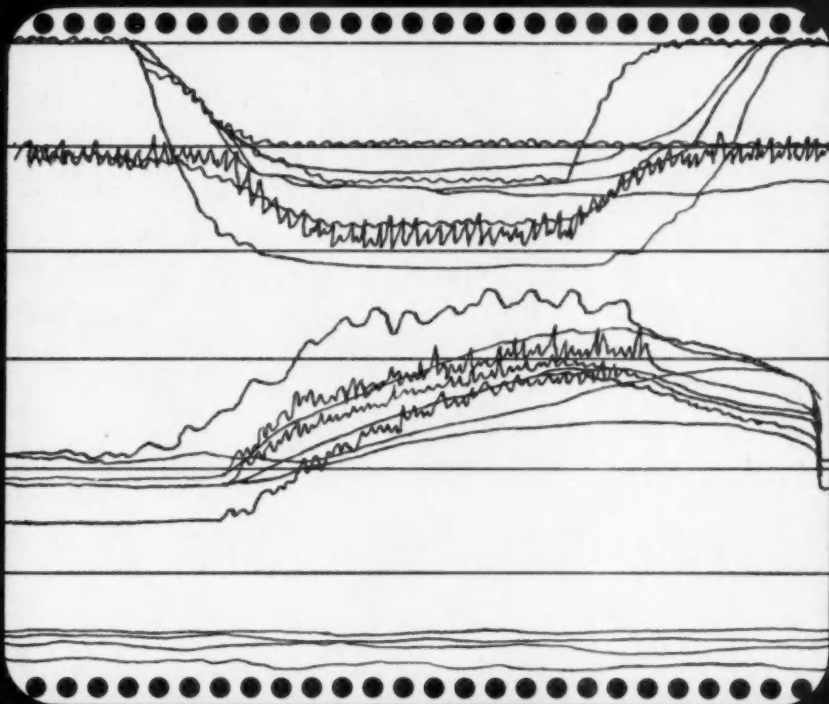
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to provide
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for you



Newest Bendix Mobile Brake Laboratory ready to take to the road with its electronic test equipment to check out heavy-duty brakes.

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This chart is the result of rugged, on-the-road brake "physicals" that we give constantly in our Bendix Mobile Brake Laboratory. And it's a big reason why you can rely on Bendix brakes for safer, more dependable performance under all loads and over all roads.

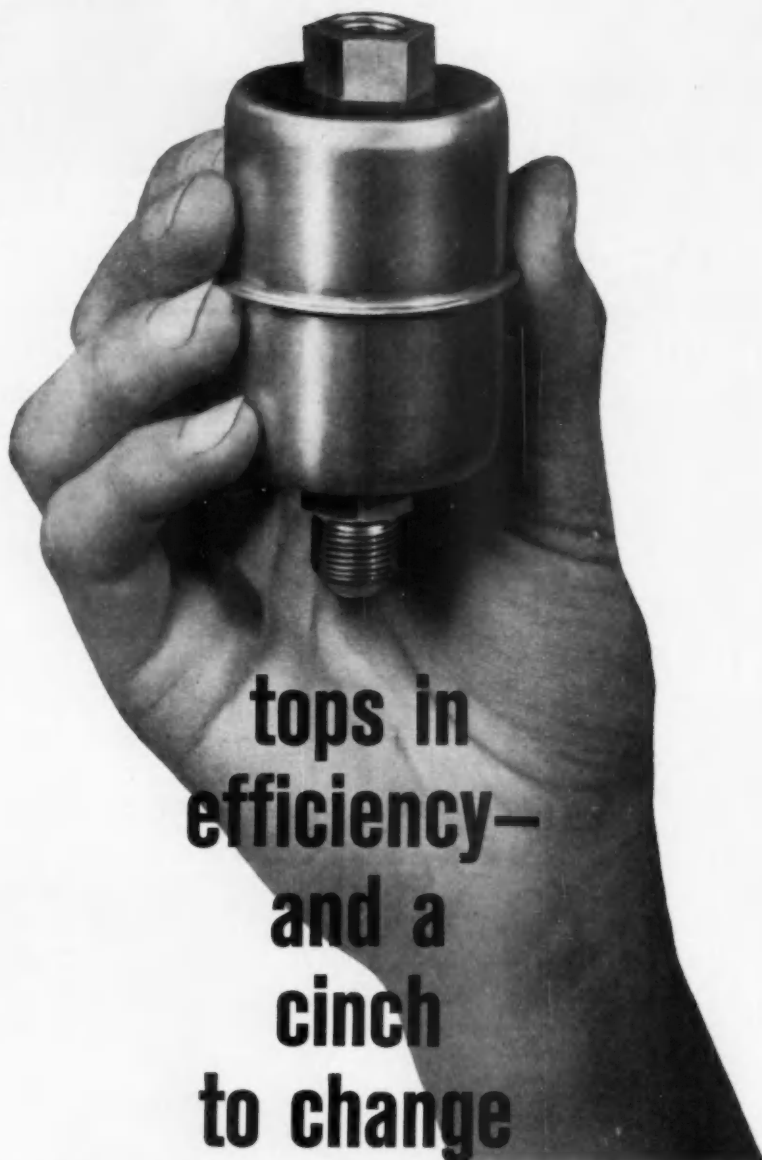
Here's the story. Advanced electronic gear aboard our mobile lab picks up and records 25 different "performance factors" of the brakes under test. Here, in chart form, are complete, scientific measurements in

six vital areas: 1. air and hydraulic actuating pressure; 2. deceleration; 3. stop time; 4. lining, drum, and hydraulic fluid temperatures; 5. travel of actuating cylinder pistons; 6. stopping distance. This charted data enables Bendix engineers to determine the exact degree of braking efficiency.

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and a
cinch
to change**

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***LONGER SERVICE LIFE.** Because of the special pleated construction of the filtering unit, the GF-11 has fully *70 square inches* of filtering surface. It operates longer at peak efficiency.

***COMPACTNESS.** The GF-11 measures about 3" by 1½". It can be installed either horizontally or vertically.

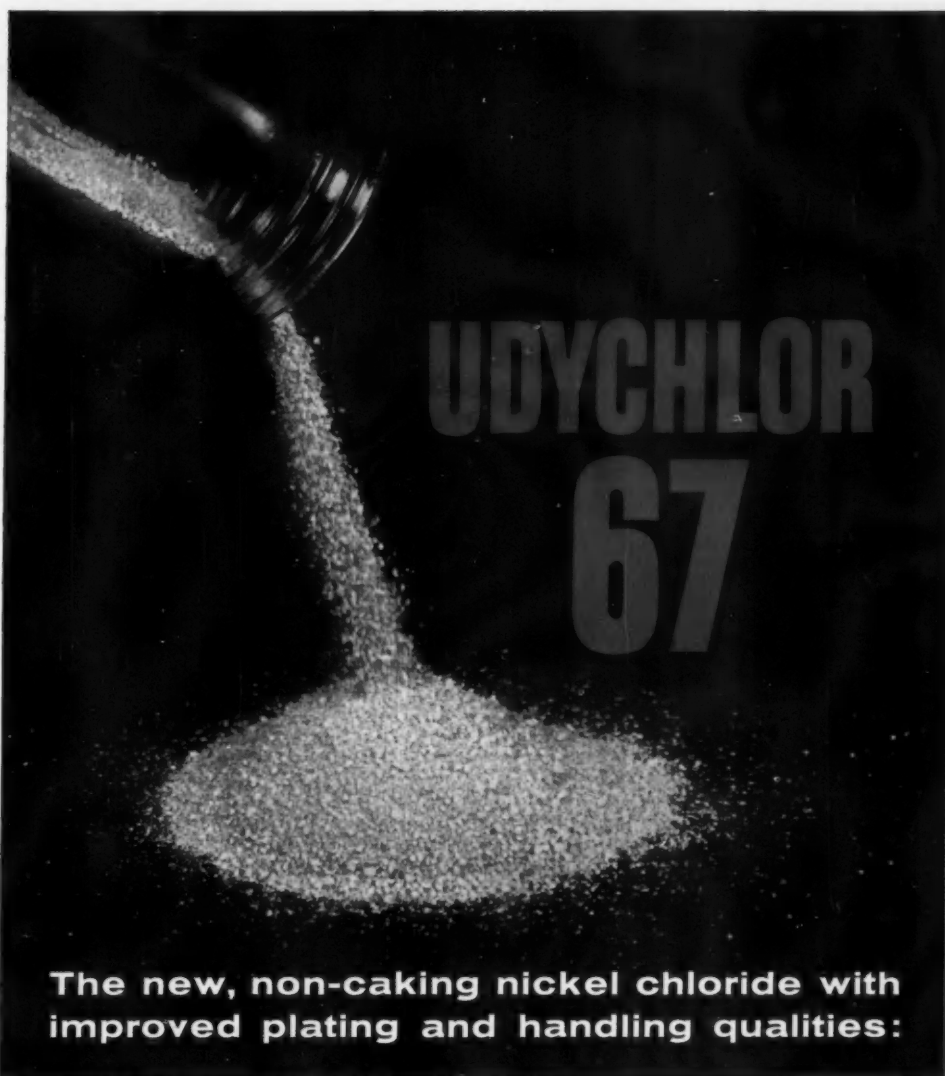
***VERSATILITY.** The GF-11 Filter can be installed as an O. E. M. item on practically any gasoline-engine — from sport cars and garden tractors to power mowers and midget racers.

For complete information on the GF-11 and other Purolator filters, write to Purolator Products, Inc., Department 3849, Rahway, New Jersey.

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CALENDAR

OF COMING SHOWS AND MEETINGS

International Automobile Show,
New YorkApr. 1-9

Society of Automotive Engineers,
National Aeronautic Meeting,
New YorkApr. 4-7

Institute of Environmental Sci-
ences, 1961 Annual Meeting and
Equipment Exposition, Wash-
ington, D. C.Apr. 5-7

Management Engineering Confer-
ence, American Society of Me-
chanical Engineers, Society for
the Advancement of Manage-
ment, New York CityApr. 6-7

American Society of Mechanical
Engineers, Oil & Gas Power
Conference & Exhibit, New
OrleansApr. 9-13

American Society of Mechanical
Engineers, Maintenance & Plant
Engineering Conference, War-
cester, Mass.Apr. 10-11

American Society of Lubrication
Engineers, Annual Meeting,
PhiladelphiaApr. 11-13

Annual National Truck, Trailer &
Equipment Show, Sponsored by
the Automotive Council of Los
Angeles, Inc., Los Angeles, Apr. 13-15

Instrument Society of America, 7th
National Symposium on Instru-
mental Methods of Analysis,
Houston, TexasApr. 17-19

American Welding Society, 42nd
Annual Convention and Weld-
ing Exposition, New York...Apr. 17-21

43rd Anniversary National Truck,
Trailer & Equipment Show, Los
AngelesApr. 13-15

Instrument Society of America,
Symposium on Instrumental
Methods of Analysis, Houston
Apr. 17-19

Westinghouse 25th Machine Tool
Forum, PittsburghApr. 19-20

18th Annual Western Section Con-
ference, Society of the Plas-
tics Industry, Inc., Coronado,
Calif.Apr. 20-21

American Society of Mechanical
Engineers, Metals Engineering
Conference, Pittsburgh ...Apr. 23-26

1961 Powder Metallurgy Show &
Metal Powder Industries Fed-
eration Meeting, Cleveland, Apr. 24-26

American Foundrymen's Society,
65th Annual Castings Congress,
San FranciscoMay 8-12

Design Engineering Show and Con-
ference, DetroitMay 22-25

American Society of Tool & Manu-
facturing Engineers, 1961 Engi-
neering Conference & Exhibit,
New YorkMay 22-26

Society of Automotive Engineers,
Summer Meeting, St. Louis...June 5-9

American Society for Testing Mate-
rials, Annual Meeting, Atlantic
City, N. J.June 25-30

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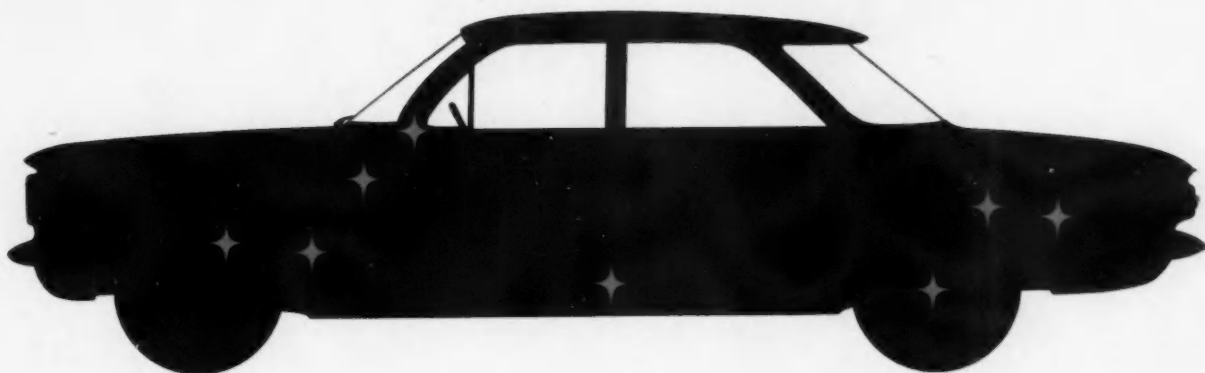
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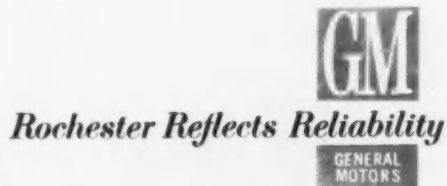
Imagination—the key ingredient in automotive engineering—is taking new turns with tubing at Rochester.

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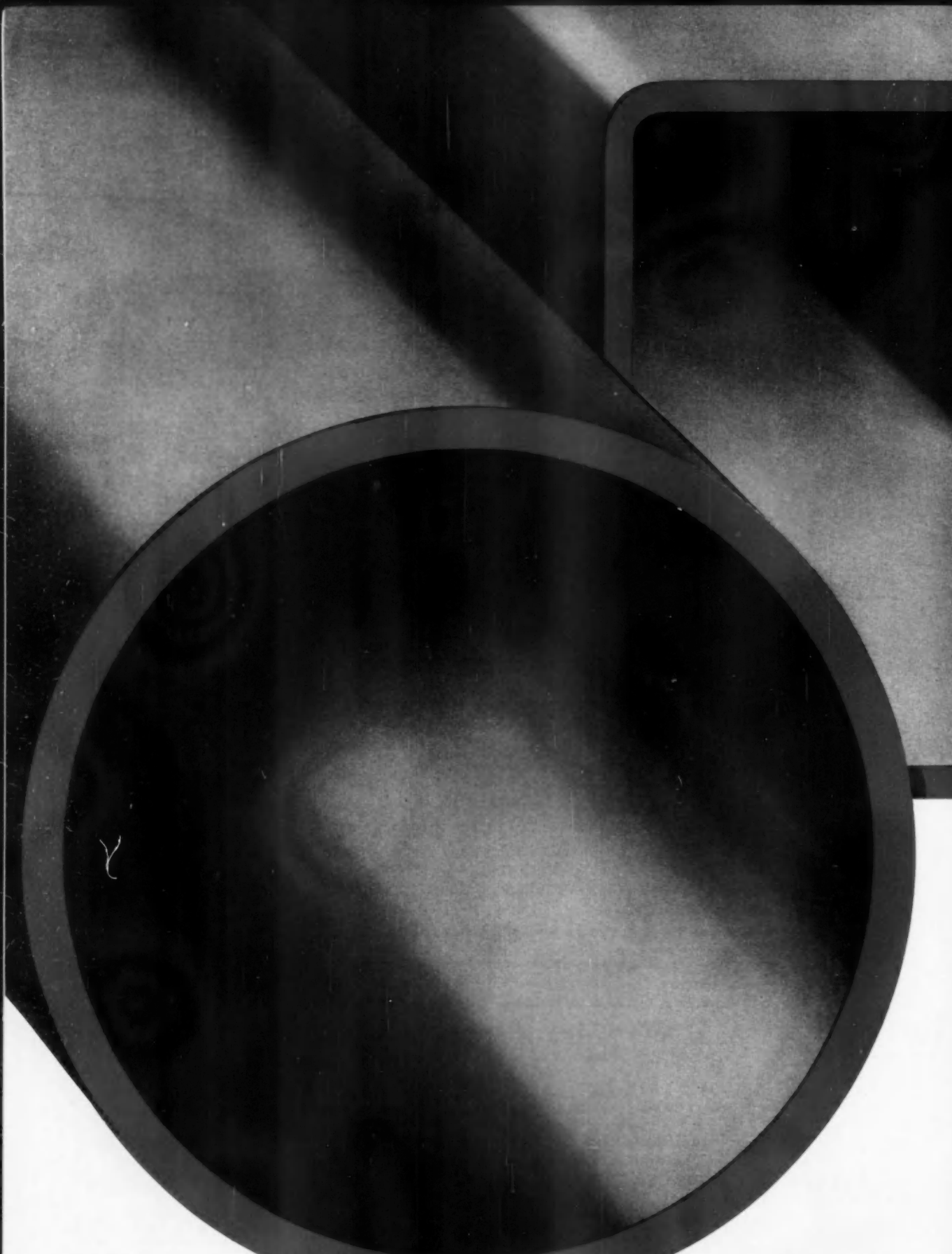
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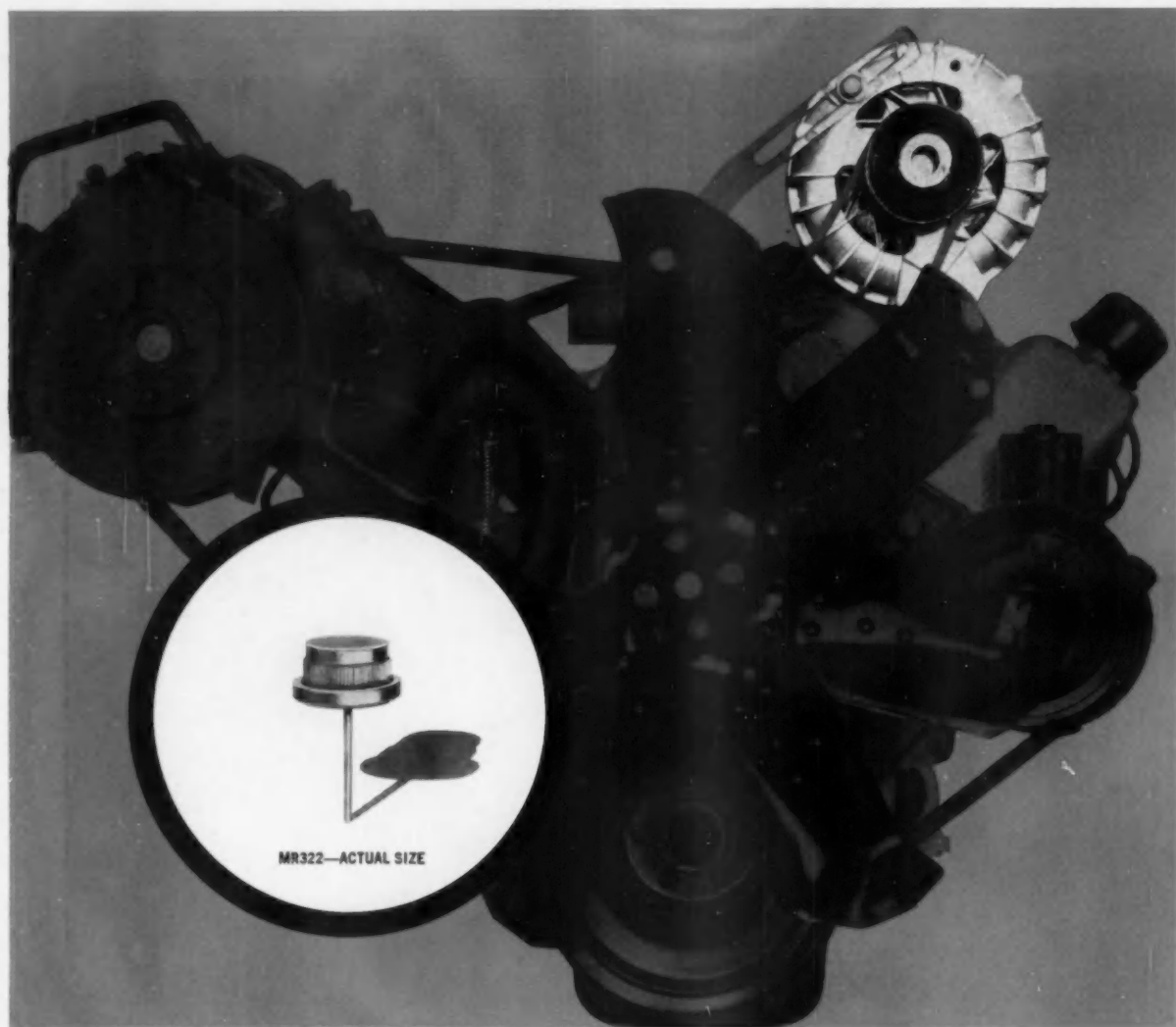


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For complete technical information on Motorola Semiconductors and details on applications assistance, contact your Motorola district office or write: Automotive Applications Department, Motorola Semiconductors Products, Inc., 5005 East McDowell Road, Phoenix 10, Arizona.

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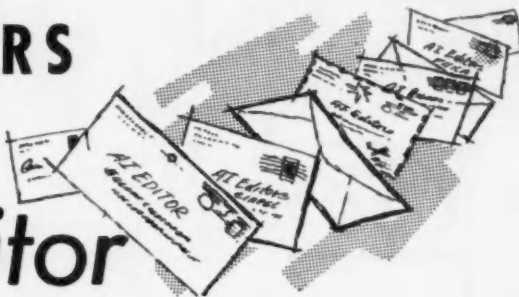
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LETTERS

to the

Editor



Readers' opinions or requests for additional information on material appearing in the editorial pages of **AUTOMOTIVE INDUSTRIES** are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address *Letters to the Editor*, **AUTOMOTIVE INDUSTRIES**, 56th & Chestnut Sts., Philadelphia 39, Pa.

DISPLAY DESIGN

I read with considerable interest your "Designing a Display of Tomorrow's Transportation" (February 1) and, following the frustrating proposal in the final paragraph, would very much enjoy seeing the brochure mentioned.

From whom may we obtain it—neither McLouth Steel nor the Wm. M. Schmidt Associates' address being mentioned. I think you should publish the address where this brochure may be obtained, as I am sure many others will want to follow my lead.

Whitley H. Harris
Douglas Aircraft Co., Inc.
El Segundo, Calif.

● *We're with you: William M. Schmidt Associates, 20304 Harper Avenue, Harper Woods, Michigan.—Ed.*

DFA

We have been receiving a great deal of very favorable response to the "Forging Ahead" article in your February 1 issue. Thought you would be interested in knowing about it. Incidentally, we are greatly impressed with the quality of your circulation.

Jon E. Jenson
Staff Representative
Drop Forging Association
Cleveland, Ohio

MUFFLERS

This office subscribes to your publication, and I am reasonably sure that I saw an article in one of your issues some time ago describing the automobile muffler made from aluminized steel.

The question has come up among some of my associates that the aluminized steel muffler may not

be such a durable product as claimed earlier, due to the fact that the aluminized product is not used for the inside baffles.

Would you have any opinions on this point? Could you refer me to the issue carrying the article I recall having seen, or preferably, could you send me a copy of this article?

John L. MacLaren
Aluminum Limited Sales, Inc.
Detroit, Mich.

● *What we have to offer is on the way—Ed.*

QUALITY MOVIES

In the March issue of **AUTOMOTIVE INDUSTRIES**, you had an editorial entitled "Buying Quality Is Now Foremost" which I found very interesting. Mentioned in this article was a 20-minute technicolor motion picture entitled "A Matter of Responsibility" which I would like information on. Is this movie available for our company use? Any information concerning this film will be greatly appreciated.

Keith Moore
Hamilton Cosco, Inc.
Columbus, Ind.

● *Suggest you write General Motors Corp., Detroit, Mich.—Ed.*

QUALITY CONTROL

Received the copies of "Engineering Report No. 5 on Reliability and Quality Control" this morning. First glance through indicates the usual fine **AUTOMOTIVE INDUSTRIES** work. Many thanks.

John J. Ryan
Director
Data Control & Analysis
Pontiac Motor Div.
Pontiac, Mich.

think again



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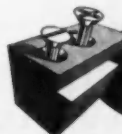
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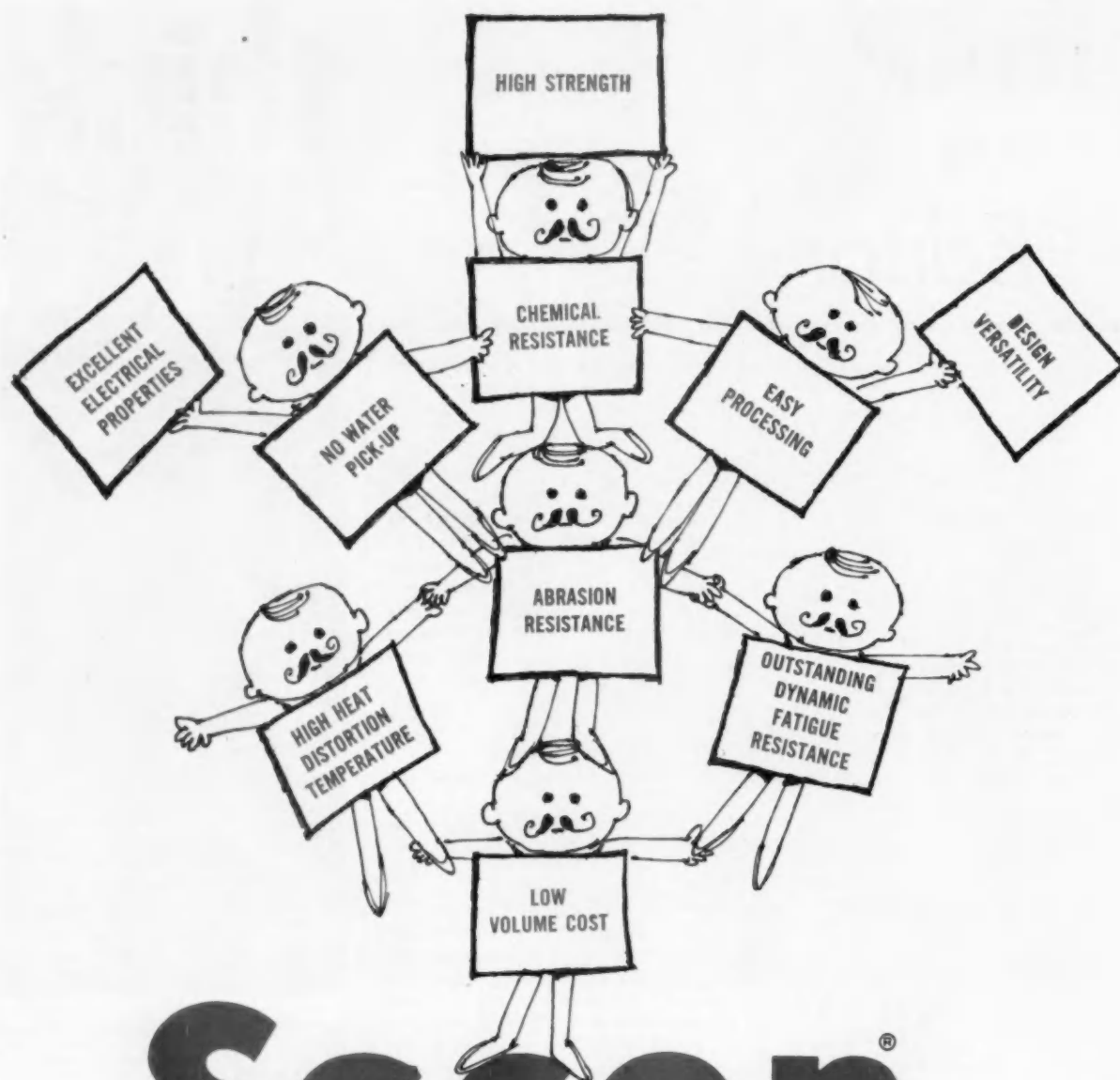
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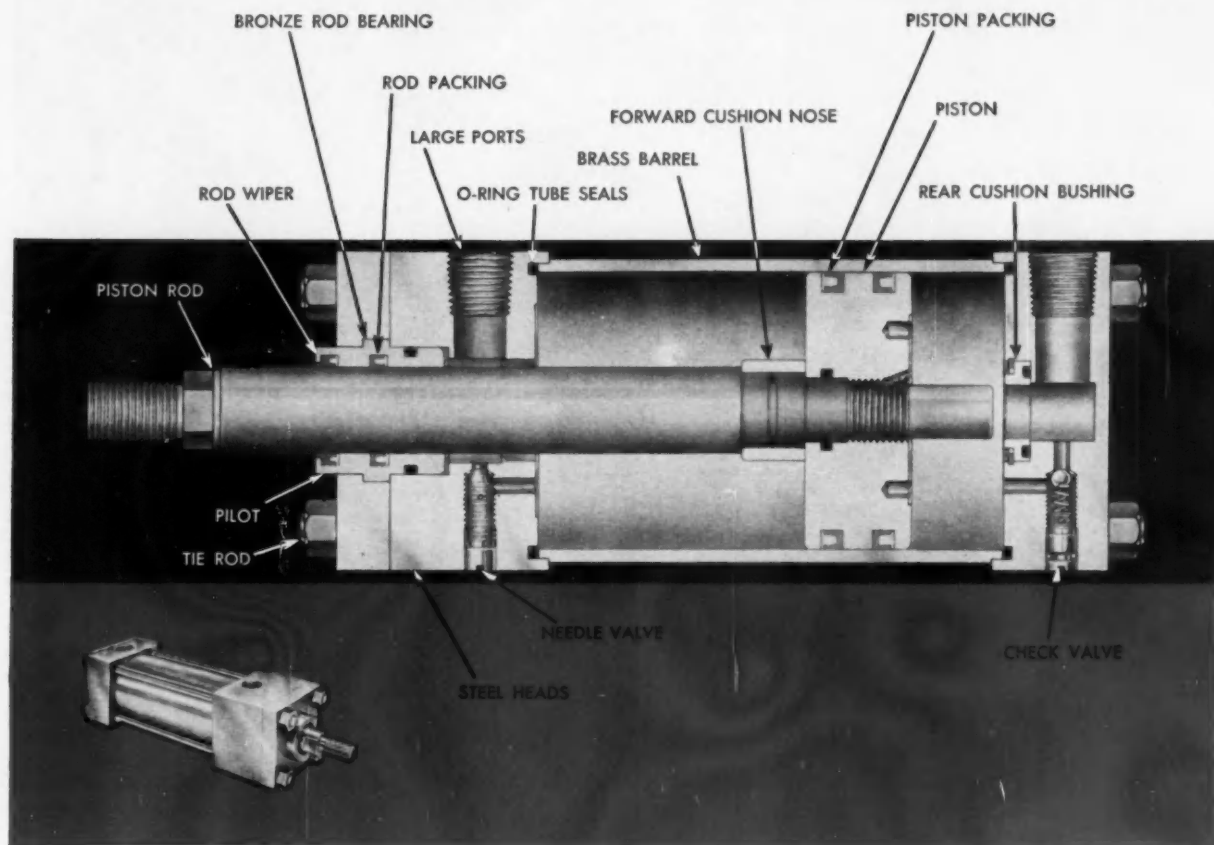
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For complete details write for Bulletin No. 115 in which all cylinders have been dimensioned in

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BCA engineers take a close, "big" look at the configuration of inner and outer rings of ball bearings with this contour projector. It magnifies profiles up to 100 times actual size—makes possible extremely accurate measurements and control of all geometric characteristics of raceway rings.

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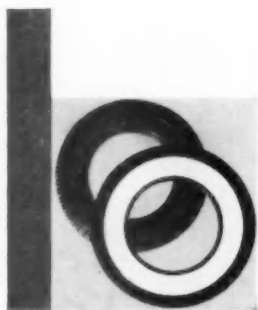
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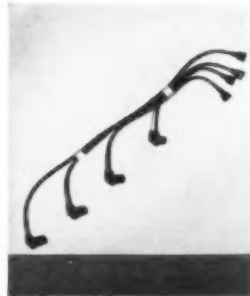
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HYPALON synthetic rubber provides qualities not available in conventional elastomers for automotive design problems. HYPALON can be compounded to give a completely ozone-proof and color-stable elastomer with excellent weather, abrasion, oil and heat resistance.

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SYNTHETIC RUBBER

NEWS

Vol. 124, No. 7

April 1, 1961

Grede Hails '61 Outlook Expects Rise in Farm Equipment Sales

Farm equipment manufacturers are confidently expecting an increase in business over 1960.

This was the theme of William J. Grede, president of J. I. Case Co., in an exclusive interview with AUTOMOTIVE INDUSTRIES.

Mr. Grede said he based his optimism on increased farm income, the tendency of farmers to spend money for equipment following a good crop year, and the need for new machines to meet new farming practices.

Cites Increased Income

"Increased farm income and the tendency of the farmer to spend money following a good crop year encourages the industry to anticipate sales at least equal to the 1960 level," Mr. Grede declared.

"Following the pattern of previous experience, it would appear that the farm equipment manufacturer may look for some increase in business. J. I. Case Co. sales in the farm machinery field may exceed that formula in view of the past year's experience and the enthusiasm of our dealers for our complete product line.

"The demand for new equipment to meet new farming practices will,

we believe, continue over the balance of 1961 and into the future. Major farm equipment manufacturers are generally well prepared to take advantage of this market. Case is in a very favorable position in this regard because of the introduction of new products during 1960 and the continuing research and development program which the company emphasizes.

Price Gap Closing

"A significant factor in the equipment market is the gradual closing of the gap between the price of new and used equipment, making the purchase of late run products more economical and desirable.

"The developing trend in the farm market towards the use of low-cost fuel will broaden the demand for power equipment that has been engineered to meet the requirements of Diesel fuel consumption.

"The economic consideration of higher wages for farm labor in view of the present effort of unions to organize farm workers will lend impetus to the farmers' desire for more automation. These factors, added to increasingly large farm-

ing operations which require modern, high-speed units, develop an optimistic sales picture."

SAE's Record Parley

The combined automobile and production meetings of the Society of Automotive Engineers attracted a record number of delegates for the March 13-17 Automobile Week in Detroit.

Speakers discussed the scope of responsibility and communications between product engineering, manufacturing and product planning. Also discussed were steering and suspension joints requiring no service lubrication; radio interference suppression; flexibility and car assembly operations; unitized and body-frame construction; power-operated body mechanisms; safety problems; new ideas in drivelines; molded parts for body interiors; anti-corrosion advances; quality control vs reliability, and steels for tomorrow's autos.

Porta Quits S-P

Armando J. Porta, executive vice president and general manager of Studebaker-Packard Corp.'s Automotive Div., has resigned to become vice president of Associates Investment Co., South Bend, Ind.

Mr. Porta was the leading figure in S-P's financial reorganization three years ago.

New Compact Sports Models Will Mean More Headaches for Shrinking Imports

Sports-minded compact lovers are the latest target of Detroit auto makers who have introduced several models in the continuing assault against the shrinking imports.

The Falcon Futura, Ford's answer to the Corvair Monza, has been described as the "compact cousin of the Thunderbird." The Futura is for buyers who want "luxury appearance with economical operation," according to Lee A. Iacocca, Ford vice president and Ford Div. general manager.

Fifth model in the Falcon line, the Futura features a deluxe interior with contoured bucket seats

separated by a console. It has carpeting, brightwork window molding and large wheel covers.

Luxury Interior

Another of Ford's new models, the Comet S-22, also features a luxury interior. It too, has bucket seats and console. Its interior is entirely new. The front seats are individually adjustable.

The steering wheel has a special sports car design. Cigarette lighter and door lights are standard. The exterior has an S-22 emblem on each side. The Comet's optional brightwork is standard on the new model. Fifty lb of deadening ma-

terial have been added to insure quieter riding. The 170 cu in. Comet engine is available at extra cost.

Oldsmobile's Tempest series has been expanded to include two two-door coupes. They differ mainly in passenger compartment design. Each is a half in. less in overall height than Tempest's four-door sedan.

Bucket Seats, Carpeting

One of the Tempest coupes will have bucket seats, custom interior trim and carpeting on both front and rear floor areas.

The other will have conventional front seat, standard interior appointments, and a different rear window treatment. Exterior trim options also are available for both models. Engines range in choice from the four-cylinder with 110 hp to a 155 hp light weight aluminum V-8.

Another newcomer is the Oldsmobile F-85 three-seat station wagon. It is being offered in both the F-85 and F-85 Deluxe models. Mounted between the wheel housings, the third seat will face the rear. It will fold into the floor to permit full use of the 73 cu ft of cargo space. A recent option in all F-85 station wagons is an electrically-operated rear window in the tail gate.

Buick also has added a three-seat station wagon to its Special series. The eight-passenger wagon is offered in the standard series. Two-seat wagons are available in both standard and deluxe Special models.



Falcon Futura Makes Spring Bow



Pontiac Tempest Two-Door Coupe

NEWS

CONTINUED



Bucket Seats, Console in Comet's S-22



New F-85 Three-Seat Station Wagon

AMA Backs Road Tax

The Automobile Manufacturers Association supports President Kennedy's highway tax program, which is expected to come under heavy fire from trucking and oil interests.

The bill, designed to get more money to speed up construction of interstate highways, would cancel a scheduled one-cent cut in gasoline taxes and boost taxes on trucks, Diesel fuel, tires and other items.

Even the automobile manufacturers hedged on the money part of the proposal. In a statement read to the House Ways and Means Committee, the auto makers said "conclusions should not be reached on the proper level of commercial vehicle highway taxes" until after a study of the American Association of State Highway Officials' five-year road test.

More Synthetic Used

Consumption of synthetic rubber continues to increase and now accounts for 70 per cent of all rubber used in the U. S., the Goodyear Tire & Rubber Co. reports.

World consumption of new rubber—natural and synthetic—reached a new high of 3.7 million long tons in 1960.

Goodyear sales and earnings last year were second only to the all-time record year of 1959. Sales reached \$1,550,904,519, a drop of slightly more than \$28 million. Net income was \$71 million, compared with \$76 million the previous year.

NEWS

CONTINUED

Public Controls VW

The German in the street has taken control of the Volkswagen plant at Wolfsburg 23 years after Hitler welshed on promises to give him a "people's car" for next to nothing.

Before the war 900,000 Germans paid for Volkswagens but only a fraction of them got their cars before Hitler geared the plant to war production.

Germans with incomes less than \$4000 annually were allowed to subscribe. The requests were so heavy, however, that the maximum number of shares for each request was cut to three from five. Each share has a nominal value of \$25 but cost \$87.50 each. When stock exchange trading begins in April, the value of each share is expected to rocket.

In all, 3.6 million shares were sold to the public. This is 60 per cent of the firm's stock. The remainder is held by the Federal Government and the State of Lower Saxony, where the VW plant is situated.

Swedish Record

Swedish auto makers produced a record 128,400 units last year. In 1959 the output exceeded 100,000 units for the first time. The 1950 production was about 25,000.

Exports last year increased by 6500 to 58,775 units. About 120,000 cars were imported last year against 52,000 in 1950.

Production of automobiles since 1950 has increased fivefold and exports have risen eighteenfold. Imports have more than doubled in the same period.

Japanese Output Up

Japan's motor industry achieved impressive gains during 1960 according to figures released by the Japan Automotive Industrial Association.

Passenger car production saw the greatest advances—a jump of 110 per cent over 1959. Last year, Japan's auto manufacturers produced 128,984 passenger cars.

In the "midget" car category, 36,110 units were turned out in 1960.

The J.A.I.A. also reported production of 308,018 trucks and 8437 buses. Total production of all types was 481,549.

The export picture continued bright with 7013 passenger cars sent abroad for a 43.6 per cent increase over 1959. There were 14,135 trucks and 683 buses exported.

Brazilian Expansion

Expanding steadily in 1960, Brazil's 12 motor vehicle manufacturers produced 134,371 vehicles valued at nearly \$400 million. Some officials estimate that production will reach 160,000 this year and level off thereafter. The 1960 output was a 39.9 per cent rise over 1959.

Production included 50,097 trucks, 1751 buses, 20,294 utility vehicles, 42,705 passenger cars and 19,524 Jeeps. The largest increase was in passenger car output. There were 27,532 more passenger cars produced in 1960 than in the previous year.

150 MPH Jaguars Due

Jaguar Cars, Inc., has announced it will offer for sale to the public two types of sports cars each capable of speeds of 150 mph.

Jaguar said the XK-E roadster and XK-E coupe, both two-door, two-seaters, were "two of the fastest production sports cars ever offered for public sale."

The cars have the stressed shell, all-steel body developed in the "D" type Jaguar racing cars.

PININFARINA TESTS THREE-WHEELER



Chassis on experimental car by Pininfarina permits improved cornering, a tight turning circle and easy parking. The single front wheel is steered and the rear ones driven. These two carry three-quarters of the car's weight and provide stability on curves. The rear-mounted 43-hp engine is offset to counter-balance the driver's weight.

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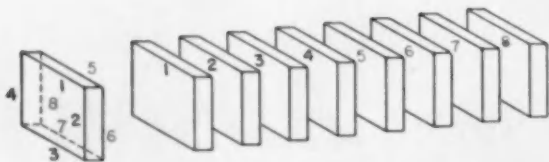
GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

How Throw-away Tool Bits...

reduce the cost of **SURFACE BROACHING**



Throw-away tool bits are one of the many plus factors in reducing the cost of this machining operation—broaching flat surface of compressor cylinder heads. The machine is a CINCINNATI Duplex Vertical Hydro-Broach with duplicate tooling. Production rate, 325 parts per 48 minute hour. Write for Catalogs M-1745-1 and M-1848-1.



C. H. Altbaier, Manager of Sales, Special Machine Division, The Cincinnati Milling Machine Co., holds a wood model of a throw-away tool bit as he demonstrates how throw-aways present eight cutting edges for broaching. (Patent pending)

In the past, throw-away tool bits have proved to be very successful in turning, milling and planing operations. Now, through an ingenious tool holder arrangement developed by Cincinnati Milling, throw-aways are used very successfully for broaching.

As an example of their cost-saving possibilities, let's consider sintered carbide bits. Using only one cutting edge, 20,000 or more parts can be broached. The bits are unclamped, turned 90° and the second edge is available to broach another 20,000 parts, and so on. Both sides of the bit are used (negative rake angle). Then there are eight cutting edges, as indicated in the drawing and demonstrated below. Thus, production totals 160,000 parts; and remember, there is no cutter sharpening expense.

The throw-away idea was one of the considerations in tooling up the Vertical Hydro-Broach illustrated at left. It is but one example of the advanced thinking and modern approach to low-cost production at Cincinnati Milling. May we send you more information? **Special Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



NEWS

FEATURES

Detroit Plants Expand Budd to Spend \$7 Million in Motor City

By James Dunne, Detroit Regional Editor,
and C. B. Campbell, News Editor

Anticipating larger markets with a more diversified demand, automobile manufacturers and their suppliers are constructing new plants and expanding present production facilities in the greater Detroit area. Plants that produce everything from raw steel to finished cars are being expanded.

The latest and one of the most important expansion moves was the transfer of the Budd Automotive Div. from Philadelphia to Detroit.

"Although the parent company

always has been, and always will be, a Philadelphia concern, the importance of our newly reorganized Automotive Div. dictates that its headquarters and executive staff be located close to our automotive customers," Edward G. Budd, Jr., president, told business leaders and reporters.

Will Spend \$7 Million

Thomas J. Ault, president of the Automotive Div., said the division will spend in excess of \$7 million

this year for improvement, replacement and expansion of its Detroit facilities.

The bulk of the \$7 million expenditure will include \$3.3 million for new foundry equipment, including a new mechanized line and other modern equipment; and \$1.6 million for installation of truck rim fabricating equipment. Modernization of Budd's brake drum foundry has been going on for nearly six years on a "staggered" basis so that there has been no loss of production.

Expenditure of \$200,000 will be made for additional research and testing equipment while miscellaneous expenditures total \$2.1 million.

Kelsey-Hayes Co. is completely modernizing its wheel-making facilities by moving that operation from two Detroit plants to Romulus township. The Romulus plant was owned by the government and contained nearly 500,000 sq ft of floor space. Another 230,000 sq ft of new buildings was added for manufacturing space.

AIR FLAP ON LATEST IDEA CAR



Model demonstrates Chrysler's newest idea car—the Turbomite—in which the entire glass canopy raises when the door is opened for entry or exit. Designed for propulsion by Chrysler's gas turbine engine, the car has many ideas which may be included in cars of the future. Rear struts support air flap which pivots upwards into airstream when hydraulic brakes are applied. It creates air drag to reduce load on brakes during turnpike cruising.

New Chevrolet Plant

Chevrolet Div. of General Motors also purchased a government plant on Mound Rd., Warren. Comprising 16 buildings and more than a million sq ft of floor space on 23 acres, the complex reportedly cost \$3.5 million. With operations expected to begin later this year, the new plant will alleviate overtaxed production facilities in other Chevrolet plants.

Chevrolet also is expanding its Corvair assembly lines at Willow
(Turn to page 27, please)

AI TABLOID

Discovery of new resources of beryllium ores suggests vast developments in the future use of this light, stiff, heat-resistant metal, now largely used in alloys and atomic energy applications.

* * *

During 1960, iron and steel companies spent \$1.48 billion for new equipment and construction, the second highest annual total on record, according to the American Iron and Steel Institute. The companies plan to spend \$1.2 billion this year to meet tomorrow's trends.

* * *

The advantages and shortcomings of 14 recently developed industrial welding techniques are surveyed in a report available through the Office of Technical Services, Business and Defense Services Administration, U. S. Dept. of Commerce. Also available are reports on the technical development of sheet alloys of molybdenum, columbium, tungsten, and tantalum, and a technical review of the characteristics of the newer nickel-base and cobalt-base superalloys used for rocket, missile and supersonic aircraft construction.

* * *

Six types of fuel cells that have proved feasible as electrical energy sources are evaluated in an Air Force research report available to the public and industry. Also available is the report on a three-year Air Force study to develop laboratory test procedures for predicting the tropical-service life of electronic components and materials.

* * *

Atom-structural factors in the strain-aging of 12 refractory metals, and development of methods and instruments for mechanical evaluation of refractory materials at ultra high temperatures are discussed in two metallurgical research reports released to industry and the public.

Results in determining the viscosity of a number of metals, as well as the relationship between the magnitude of their kinetic viscosity and certain other physical properties, are presented in a translation of a Russian metallurgy and ceramics report.

* * *

Although development of a controlled thermonuclear research program in Russia appears to match similar research in the U. S., the achievement of economically competitive nuclear power systems for Soviet industry seems doubtful for a number of years. The estimate is contained in one of six translations of Russian nuclear energy literature.

* * *

Transistorized two-and-four segment commutators have been developed for the Air Force as part of a program to find a substitute for mechanical commutators in high-speed, high-altitude aircraft. The electronic commutators are described and evaluated in two reports available to industry through the Office of Technical Services, Business and Defense Services Administration, U. S. Dept. of Commerce.

* * *

A guide to the physical properties of 33 representative nickel-base alloys is presented in a report released to industry and the public. One subdivision is a tabulation of chemical composition which classifies the 33 alloys into six groups according to the type and amount of major alloying constituent. The second contains definitions of the terms used to describe the alloys' physical properties, a survey of available data, and data sheets and graphs for each of the representative alloys.

* * *

A translation of a Soviet two-volume handbook for foundry workers on shape casting of aluminum and magnesium alloys has been released to industry and the public.



World's smallest turboprop, the Rover T. P./60, is designed as a conversion unit for light planes. The 60 hp engine weighs only 120 lb and can be fitted without major airframe changes.

A-C Restyles Scraper

Allis-Chalmers Mfg. Co. has re-designed and restyled the TS-160 motor scraper—the smallest in the company's all-hydraulic line—to increase its capacity to eight and one-half struck and 11 cu yards heaped and the payload to 13 tons.

It is powered by an Allis-Chalmers 155 hp supercharged Diesel engine.

The new scraper also features all-hydraulic operation, and double-acting steering jacks and multiplier links to give full power steering over the entire steering range.

Aerospace Officers

J. V. Naish, president of Convair, a division of General Dynamics Corp., has been elected chairman of the board of governors of the Aerospace Industries Association for 1961. H. M. Horner, chairman, United Aircraft Corp., was named vice chairman and Orval R. Cook was re-elected president.

(Continued from page 25)

Run. Expected to be completed in September, 226,000 sq ft will be added to the present building. This will more than double Corvair's floor space at Willow Run.

Fisher Body Div. of General Motors expects to complete a 205,000 sq ft warehouse addition to its trim fabrication plant in Livonia this month. Last fall, Fisher moved into a new plant of 280,000 sq ft in Pontiac for assembly of Pontiac and Tempest interior trim.

Great Lakes Steel Corp. plans to open a \$100 million 80-in. rolling mill in the fall. The mill is located between Great Lakes' two plants along the Detroit River.

Ternstedt Div. of General Motors expects to complete a new 600,000

sq ft building in Warren by Sept. 1. This will bring the engineering and administration functions under one roof in the General Motors Technical Center area.

The Tractor and Implement Div. of Ford Motor Co. completed a multi-million dollar expansion at the Highland Park plant.

Other expansions under way include: Bundy Tubing Co., third floor addition for executive offices; Eaton Mfg. Co., third building at research and development center in Southfield for automotive, marine and air research and engineering.

In addition, Federal-Mogul-Bower Bearings, Inc., is completing transfer of its heat treating lines to a new 34,800 sq ft addition to its main Detroit plant.

I-H Sales Improving

Sales of International Harvester Co. have "materially improved" from the first quarter and may be "quite close to those for 1960," for the entire year, Frank W. Jenks, president, told the annual meeting.

Mr. Jenks said I-H has stepped up production schedules in its Motor Truck, Farm Equipment and Steel and Construction Divs.

Production at the heavy-duty truck factory at Fort Wayne, Ind., was increased 18 per cent on March 27. Daily output of the Scout, Harvester's new all-purpose vehicle, was boosted 33 per cent, William C. Schumacher, executive vice president and head of the Motor Truck Div., reported.

Capital Expenditures

Businessmen plan to spend \$34.5 billion on new plants and equipment in 1961, a decline of three per cent from last year.

These figures are from the annual survey conducted jointly by the Dept. of Commerce and the Securities and Exchange Commission.

The survey indicates that businessmen anticipate the decline in investment, which began in the third quarter of 1960, will continue through the second quarter of this year. Present plans for 1961 point to a mild increase in capital expenditures in the latter half of the year.

Manufacturing and trade firms and public utilities expect to better their 1960 sales performances. They expect a three per cent rise for manufacturers up to a seven per cent increase for public utilities.

NEW THROUGH-DRIVE TRUCK AXLES



Truck with one of three new through-drive tandem rear axles by International Harvester Co. goes through paces at proving grounds. They are offered in rated capacities of 30,000, 34,000 and 38,000 lb.

Airship 'Wind Tunnel'

A new use for the Navy airship as a "flying wind tunnel" has solved the frustrating problem of testing models of vertical rising and short takeoff and landing (VTOL-STOL) aircraft, the Dept. of Defense has announced.

As part of a long-range study of low speed flight, Professor D. C. Hazen of Princeton University has established that Navy airships can be readily converted to accomplish cheaply and efficiently what would otherwise require large and expensive wind tunnels. A program for operating the large ZPG-2 airship as a flying wind tunnel is now under way under the joint sponsorship of the Office of Naval Research and the Bureau of Naval Weapons. The first flight is scheduled for next month.

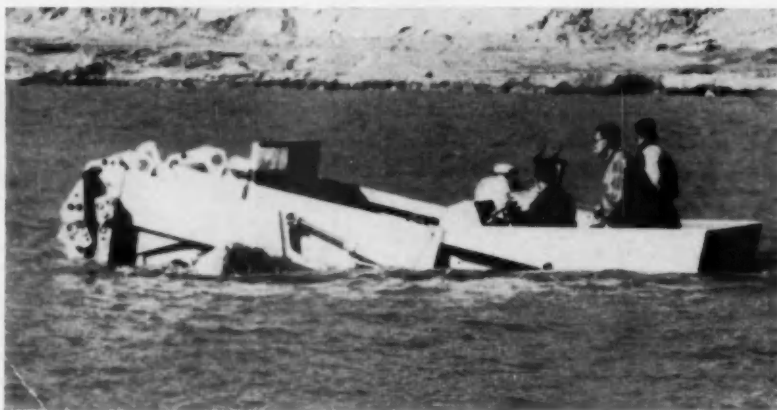
With the co-operation of the Airship Test and Development Dept. at the Naval Air Station, Lakehurst, N. J., an exploratory program of using the 285-ft ZS2G-1 airship proved the feasibility of testing VTOL-STOL models for control and stability by hanging them beneath the car (often referred to as a gondola) on a retractable strut 33 ft long.

\$570 Million Saving

Effective economy measures by 28 of 70 firms surveyed in the aerospace industry have brought about cost reductions totaling \$570 million, according to a recent Air Force survey. The survey said that these measures brought about "truly impressive cost savings concurrently with an accelerated pace in achieving Air Force research, development and production goals."

The reported savings accrued from such management techniques as improved purchasing and procurement, value engineering, reorganization and consolidation, modernization, improved methods and other measures. For example, one firm reported annual savings of \$20 million realized as a result of a formal cost reduction program. Another reported that in a single department, 2500 cost-reduction ideas over a three-year period had resulted in documented savings totaling nearly \$18 million.

AMPHIBIOUS CRAWLER TRACTOR



The Universal Engineer Tractor, built by International Harvester Co., is designed to meet modern warfare's demands for ultra-flexibility. It has the capabilities of a scraper, dump truck and prime mover. Powered by a 250 hp V-8 liquid cooled engine, it crosses rivers and lakes at four mph.

Missile Mobility

Delegates to the 20th annual convention of the Truck-Trailer Manufacturers Association, Inc., stressed the willingness of their engineers to cooperate in any appropriate way so that maximum missile mobility may be assured for U. S. defenses.

A resolution approved by the delegates, meeting in Hollywood, Fla., pointed out that missile launching pads frequently were in remote places and that only trucks or trailers could provide safe, reliable and damage-free transportation.

Fairlanes for U. S.

Ford Div. of Ford Motor Co. has announced receipt of a \$1,380,547 government contract for 950 Fairlane four-door sedans.

Vehicle allotments have been made to these eight Ford assembly plants: Dallas, 60; Dearborn, 114; Hopeville, Ga., 144; Louisville, seven; Mahwah, N. J., 372; Norfolk, 52; St. Paul, 40; and Los Angeles, 161;

The Ordnance Tank Automotive Command, Detroit bought 635 of the automobiles for the Air Force, 301 for the Navy, and 14 for the Department of Defense.

Delivery is to be completed within 90 days.

AC Given Contract

The AC Spark Plug Div. of General Motors has received a \$20 million Air Force order for production of a new navigation system for low-level bombing approaches for B-52 bombers.

The contract is expected to eventually exceed \$50 million, an AC official declared. He explained that low-level bombing approaches would be used to avoid radar detection.

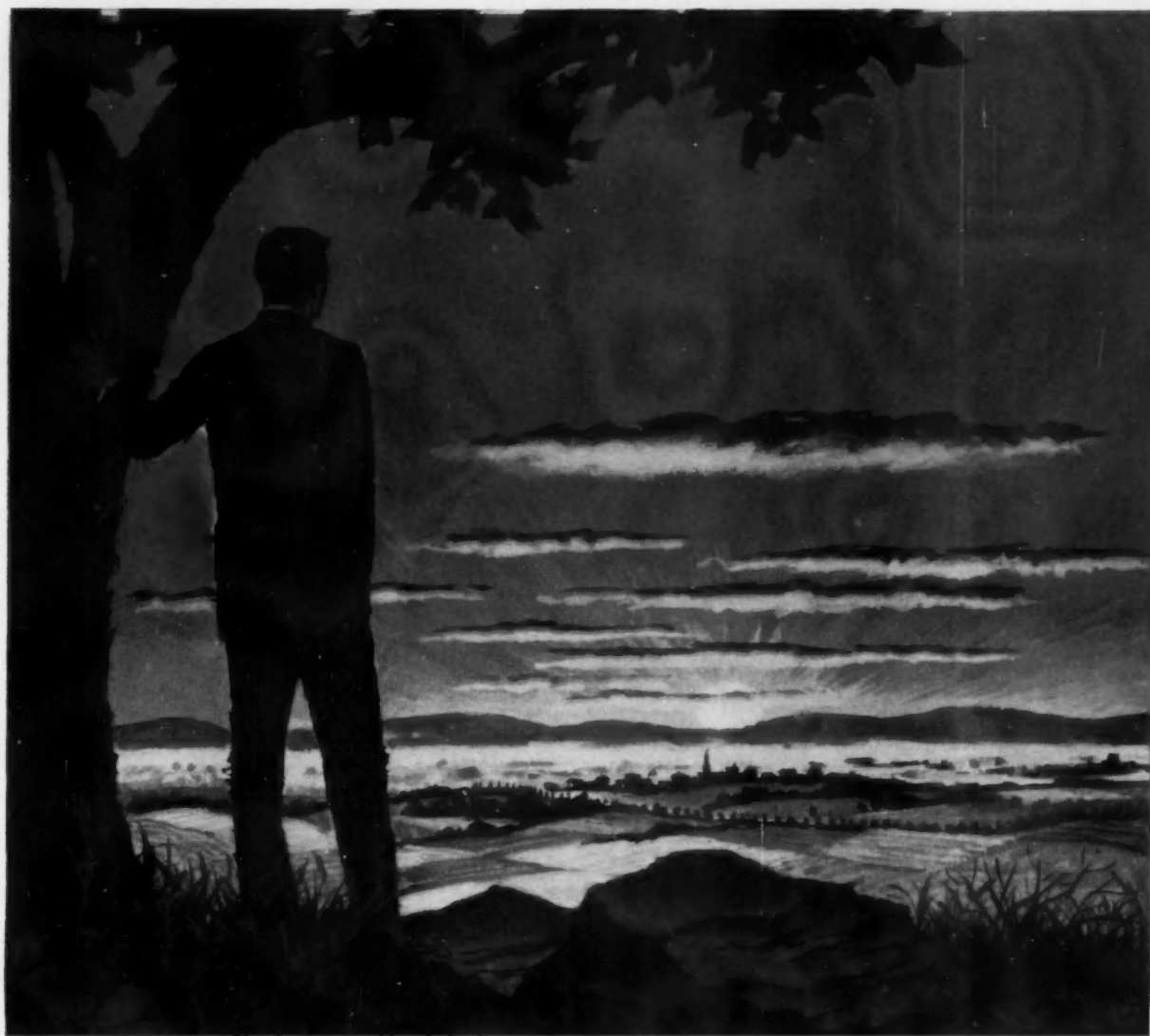
The new system also can launch the B-52's Hound Dog air-to-ground missile. The Hound Dog, with a range of 500 mi, can be launched without the B-52 entering the immediate target area.

Caribou Order

The Army has awarded a \$13.1 million contract to DeHavilland Aircraft of Canada, Ltd., for production of Caribou transport planes.

Twenty-four airframes, special tools, repair parts, technical manuals and engineering data are included in the contract.

The Caribou is the largest fixed-wing plane used by the Army. It can transport 32 passengers or 24 troops, or a three-ton payload. It has a 900-mi range.



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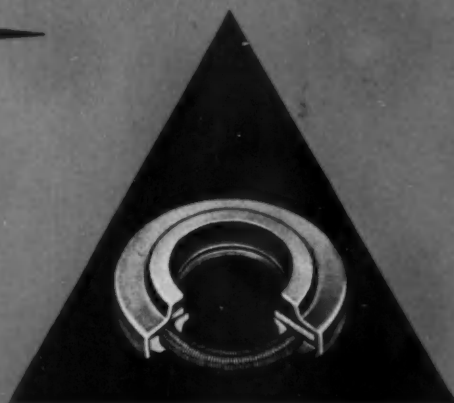
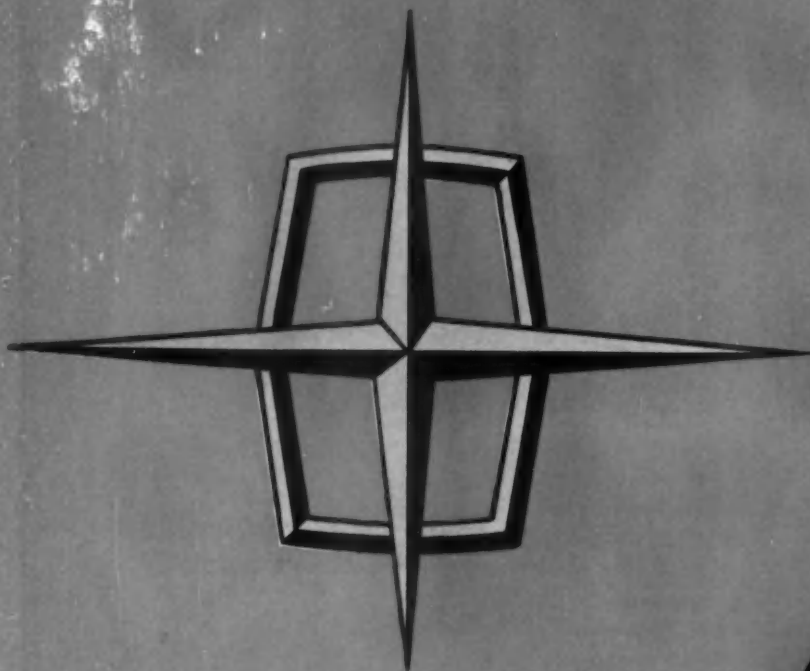
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- Prevent local hot spots
- Reduce valve stem and guide wear

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MANUFACTURING DIVISION

MEIN

IN THE NEWS



Ford Motor Co., Aeronutronic Div.—Samuel L. Sala has been named manager of automotive design for automotive electronic equipment operations.



Dana Corp., Toledo Div.—Von R. Kaufman has been promoted to manager.



Taylor Fibre Co.—John L. Wilson has been named manager of new division to produce filament-wound, reinforced plastic parts.



Stewart-Warner Corp., Alemite and Instrument Div.—Paul F. Allmendinger has been appointed engineering manager.



Eaton Mfg. Co., Axle Div.—William M. Kelly has been promoted to manager of government sales.



Standard Screw Co., Chicago Screw Div.—Raymond M. Kure has been promoted to plant controller.

Ford Motor Co., Ford Div.—Wilbur Chase, Jr., has been named head of the Midwest regional sales office in Chicago and has been replaced by John F. McLean, Jr., as truck marketing manager.

General Tire & Rubber Co., Export Div.—John A. Aron has been promoted to general manager.

General Motors Corp.—Eugene D. Foley has been promoted to manager of the dealer organization dept. of the sales section.

Jones & Laughlin Steel Corp., Stainless and Strip Div.—Stuart O. Schaefer has been named Detroit plant industrial engineer and Richard L. Watterson has been appointed Louisville plant industrial engineer.

General Motors Corp., Buick-Oldsmobile-Pontiac Div.—Henry T. Brian has been appointed manager of the Arlington, Tex., assembly plant.

United States Rubber Co.—Howard E. Drew has been promoted to manager of Chicopee Falls, Mass., tire plant.

Fairco Industries—Gilbert F. Roswell has been elected president.

General Motors Corp., Delco Moraine Div.—Ross Kettering has been promoted to service manager and James Hovorka has been named sales manager of automotive assemblies.

American Oil Co.—Joseph E. Cleverger has joined the research staff.

Dura Corp.—E. L. Coveney has been appointed general manager of Moto-Mower, Inc., a Dura subsidiary.

Arwood Corp.—Leland Hargraves has been appointed manager of Los Angeles plant and Fred W. Dischinger has been named manager of the LaVerne, Calif., plant.

Scovill Mfg. Co., Schrader-Scovill International Div.—Russell C. Flood has been appointed general manager.

Huck Mfg. Co.—Charles F. Marschner has been appointed manager, fastener development.

Allis-Chalmers Mfg. Co., Industries Group—M. M. York has been promoted to director of industry coordination.

Ford Motor Co., Aeronutronic Div.—Richard A. Powley has been promoted to manager of new Manufacturing Staff.

Jones & Laughlin Steel Corp., Stainless and Strip Div.—Charles J. Brown has been named executive vice president and Donald F. Limburg has been appointed service metallurgist.

Ex-Cell-O Corp.—Russell D. Hughes has been named assistant general manager of the Costa Mesa, Calif., plant of Cadillac Gage Co., a subsidiary.

Eaton Mfg. Co., Axle Div.—Chester D. Christie has been appointed general manager and William S. Hammel was named sales manager.

Ford Motor Co.—F. E. Zimmerman has been appointed marketing staff sales training director.

Necrology

Joseph Swanson, 73, retired Studebaker-Packard Corp. New York district manager, died March 13 in Nyack, N. Y.

Henry S. Richard, 53, director of racing for the Firestone Tire & Rubber Co., died March 9 in Akron, O.

Howard W. Irish, 59, Ford Motor Co. engineer and former engineering supervisor for Packard Motor Car Co., died March 7 in Detroit.

Leslie H. Middleton, 56, former vice president and director of engineering for the Electric Autolite Co., died March 6 in Toledo, O.

Norman A. Rowe, 49, director of advertising and public relations for Fruehauf Trailer Co., died March 3 in Southfield, Mich.

Roy L. Burton, 68, retired executive secretary of the Automotive Exhaust Research Institute, died Feb. 25 in Rocky River, O.

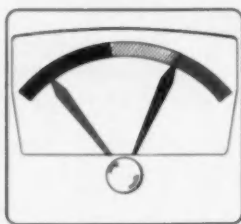
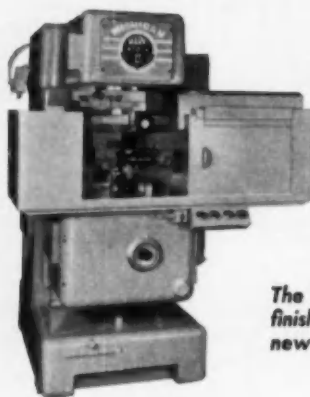
Crane Packing Co.—Glenn Moore (far left) has been named treasurer, and Carlton N. Chandler has been appointed vice president-finance.



SOLUTIONS TO GEAR PROBLEMS

WANTED: AUTOMATIC WARNING WHEN SHAVING CUTTERS ARE DULL

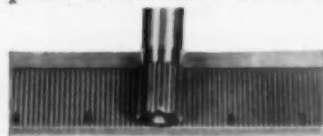
This has been solved in the new Mark II gear finisher. An indicator connected to the cutter drive circuit registers power required to drive the cutter, warns when preset 'dullness' is reached. Device also protects against cutter breakage by dropping the machine knee or warning if an oversize gear should be loaded into the machine. Ask for Bulletin 870-60.



The Mark II gear finisher is full of new features

WANTED: A SIMPLER WAY TO PRODUCE SPLINES 'FOOLPROOF' IN ASSEMBLY

Such splines can be produced without additional operations or time on Roto-Flo machines. A foolproof double-width index-locating spline tooth is created simply by grinding off one end of the forming rack teeth at the locating point. Incidentally, the Roto-Flo produces such a spline in just a few seconds. Ask for Bulletin RF-60.



A Roto-Flo produces splines, threads, grooves, in one pass

WANTED: A WAY TO GET RID OF SETUP AND 'FEEL' ERRORS IN INVOLUTE CHECKING

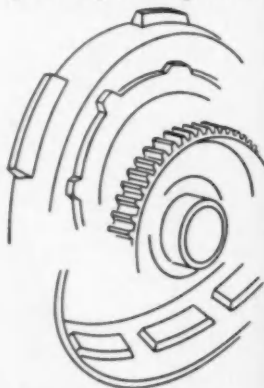
To answer this, we now have available an optical attachment for setting the sine-bar on ANY Michigan Tool #1124 involute checker. Remarkably fast and provides greater setup consistency for increased accuracy. Ask for Bulletin 1124-60.



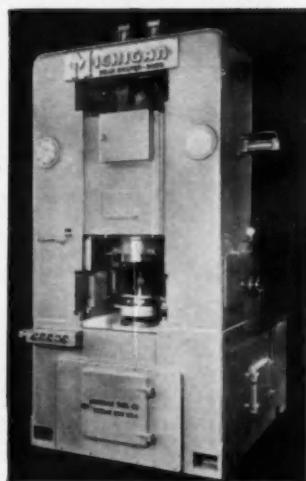
Fast optical sine-bar setting on an 1124 involute checker

WANTED: A SINGLE PROCESS FOR CUTTING ALL KINDS OF INTERRUPTED TOOTH FORMS IN DIFFERENT MATERIALS

We already had the answer to that: the Shear-Speed gear shaper. This machine will cut practically any peripheral shape—spur involute and straight teeth, interrupted or not, cam forms, ratchets, etc., in steel, cast iron, aluminum, and even plastics—in a small fraction of the time required by other processes. Ask for Bulletin 3000-60.



(above) A few of the many shapes produced in one plant by the Shear-Speed



MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN

an Editorial



Experts Predict Upturn

THE SECOND QUARTER IS OPENING with firm predictions of an upturn for production and sales for the entire industry. There are also many analysts who predict additional upturns throughout other major industries. The National City Bank said in late March—"an upturn in general business activity is simply a matter of time. . . . Final demand (The Gross National Product less the element of inventory accumulation or liquidation) has continued to push higher."

DURING THE FIRST QUARTER, sales and output of passenger cars got off to a slow start. Bad weather hurt retail sales in mid-winter. Production schedules were cutback substantially late in the quarter. In reviewing this aspect, several automotive top executives pointed out that the first quarter in 1955, a record year, also was not up to earlier expectations. Generally, the trend at the end of April is considered the key barometrical indicator which has the most value in economic trend evaluation. Therefore both production and sales during April will come under even more intensive scrutiny than during previous months.

WHILE THE EARNINGS FIGURES for the first quarter will be less than satisfactory for the most part, manufacturers will not be too greatly upset by these reports because much of the dead weight and excessive expense has been cleaned out of operations. Some plants have divested themselves of loss-product categories and some supplier companies have disposed of entire divisions of loss-product items. With more ample financial strength represented generally throughout the industry, the improved outlook for the

second quarter will definitely stimulate many profitable development programs.

BRIGHTER SITUATIONS WERE NOTED during the first quarter in the farm equipment, construction equipment, industrial engine, marine engine, automotive parts, aircraft engine and some other related fields using internal combustion engines or producing them. The continuing strong upsurge in the small gasoline engine field has been spectacular.

MEANWHILE, TO KEEP THINGS IN PROSPECTIVE, it is worth while to look back at 1960 financial results in order to see just how big the automotive industry is from an earnings standpoint. Last year 48 companies, in the automobiles and parts fields, reported net income after taxes of \$1,613,398,000 according to FRB. The FRB report for profits after taxes of all member commercial banks was only \$1,257,000,000. The most notable performance in 1960 was turned in by the petroleum industry as a result of industry-wide efforts to pare expenses and raise efficiency.

NOW THAT THE SEEDS OF BUSINESS recovery seem to be sprouting, management must take advantage of 1961 opportunities to improve output and reduce costs before machine tools, equipment, materials and supplies enter into a future resumption of long-delivery-date and virtually "seller's market" conditions. While it seems unlikely that a "seller's market" will reappear quickly, it may be profitable to remember that hardly anyone has ever adequately anticipated the reappearance of such markets in the past. With price rises now looming for late fall and 1962, the prospects of active and heavy buying are growing brighter every week.

H. W. Barclay
Editor and Publisher



WELD LIGHT GAUGE STEEL WITH AIRCO'S NEW AIRCOMATIC CO₂ GUN—THE AH 30-A

Want to do a production job on steel 3/16" or less . . . economically . . . in any position . . . without edge preparation . . . no clean up and practically no spatter? Get the Aircomatic AH 30-A gun. • **Lower in price**, easier to handle, and more versatile than anything in its class, the Aircomatic AH 30-A is a nimble companion to the rugged AH 60-B gun. Its gooseneck nozzle gets it into the hard-to-reach places. Its expendable parts can be replaced with ease. Air-cooled — no plumbing! • **Wire feeder: any Airco type**, including the inexpensive AHF-D shown here. Wire sizes: the popular .035"-.045" diameters. Gases: argon, argon-O₂ mixtures,

money-saving CO₂ from the Pure Carbonic Co., and argon-CO₂ mixture. Rating: 300 amps DCRP CO₂ buried arc or 200 amps DCRP spray transfer.

• **Airco produces the industry's most complete line** of manual and automatic gas-shielded arc welding equipment: welding heads . . . holders . . . guns . . . wire . . . wire feeders . . . welding machines . . . gases . . . accessories. To profit most, whatever you weld, make use of Airco experience. Look for your nearest Authorized Airco Distributor in your Classified Telephone Directory under "Welding Equipment & Supplies" or call your local Airco office.



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International Harvester's NEW ASSEMBLY PLANT

THE *biggest* and the *smallest* vehicles in the International Harvester line are built side-by-side in the new assembly building in Fort Wayne. Biggest are the DC 405—same as those made in Emeryville, Calif.—and the R 230 D off-highway Diesel; smallest is the 100-in. wheel-base Scout announced recently.

Assembly is handled in the plant recently acquired from U. S. Rubber. It is a WWII building with around 400,000 sq ft of manufacturing floor space on a plot of some 60 acres. The plant was completely rebuilt on the inside, tailored specifically to the desired floor plan.

The floor plan, reproduced here, shows the extreme simplicity of the layout. Scout facilities take up something less than half of the plant, as shown, with the final assembly line starting at the extreme left top of the drawing. Heavy duty fabrication takes place in the lower section with chassis assembly starting at the extreme lower right hand corner.

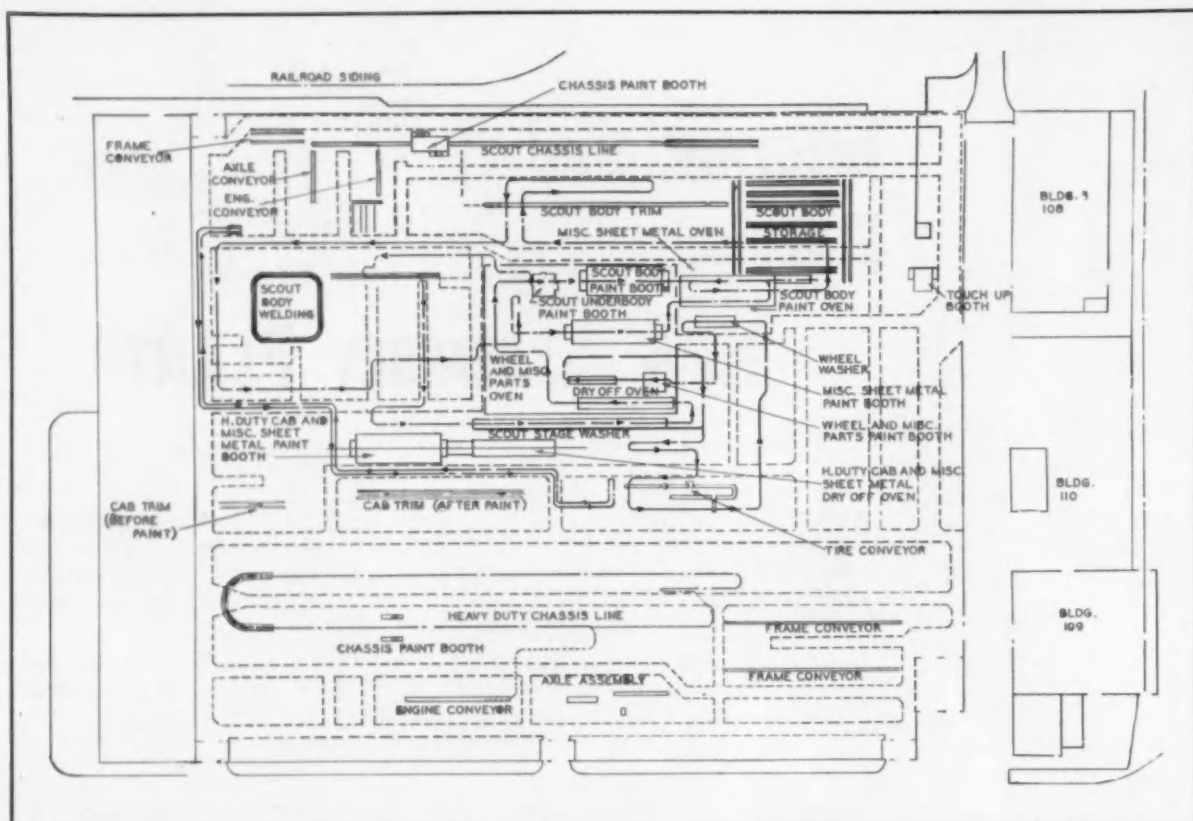
The universal type Scout body is fabricated completely, trimmed, and

**By
Joseph
Geschelin**

DETROIT EDITOR

Here
are the biggest
and the smallest
vehicles produced
in the new plant at
Fort Wayne





Floor plan of Scout assembly plant, acquired from U.S. Rubber Co. Scout assembly starts at the upper left hand corner. Assembly of heavy duty vehicles starts at the lower right hand corner.

painted in this plant. One of the special features of the layout is the rectangular enclosure approximately in the center of the floor plan which houses the spray booths and drying ovens for the Scout body. Incidentally, this is the only walled interior that was retained from the

original structure. To prevent entry of dust and dirt, this enclosure is held constantly under positive air pressure. Spray booths also have their own facilities for

operation under low air pressure.

100-IN. WHEELBASE SCOUT ASSEMBLY

Scout production begins with the

SCOUT MERRY-GO-ROUND WELDING LINE

OPERATIONS ON SCOUT BODY ASSEMBLY

Near Right—
Perspective view of the square-shaped merry-go-round welding line for fabricating Scout bodies. The fixture in the foreground shows one of the initial framing operations. The body is completely welded at five stations.

Middle Right—
This is the body drop on the Scout final assembly line. Wheel and tire delivery, as described in the text, is by means of a conveyor within the assembly conveyor structure. Several wheel and tire assemblies may be seen coming up from the basement through the floor opening in the center foreground. The spiral coil touching the floor at the right is one of the many flexible connections for the air line feeding the air tools.

Far Right—
Long perspective of the Scout final assembly line taken as the vehicles come off the line for testing and adjustments.



fabrication of the standard body by welding in a series of five massive framing fixtures moving on the square-shaped merry-go-round line seen at the left on the floor plan. After the body has been welded into an integral assembly, it follows the usual course of metal finishing, chemical cleaning and zinc-phosphate coating for corrosion resistance before entering the paint booths for color coats.

Bodies now go to the storage bay at the right to await their scheduled turn down the trim line—some 210 ft in length.

Assembly of the Scout starts at the upper left with the frame conveyor. Following the usual procedure, the front and rear axles and suspension assemblies produced on a conveyor off the assembly line are attached to the frame. Engines from the dress-up line then are dropped into place. Assembly operations begin on the final line running some 360 ft in length. The line passes through the chassis spray booth just after the engine has been installed; and the body is dropped in place just after the chassis leaves the spray booth.

Noteworthy feature of the line at this point is found in the way wheel and tire assemblies are delivered to the wheel installation stations. Wheel and tire assemblies are made up in the basement,

thus posing a problem of delivery to the assembly line. The final arrangement, illustrated here, consists of an independent conveyor system rising through an opening in the floor and running entirely within the framework of the assembly conveyor in this area. Not only does it simplify handling; it also conserves considerable floor space.

Another interesting trick is found on the assembly line in the area where the steering wheel is installed on the column. To make sure the wheel is centered properly, the conveyor is fitted with a spring-loaded bumper bar on each side. This has the effect of keeping the front wheels in straight-ahead position during steering wheel assembly.

HEAVY DUTY VEHICLE ASSEMBLY

Let us now shift to the heavy duty vehicle area. Here the cabs are received primed and glazed, from a supplier, hence do not require fabrication. They are sanded and masked before entering the paint booth. Trimming operations are performed both before and after painting.

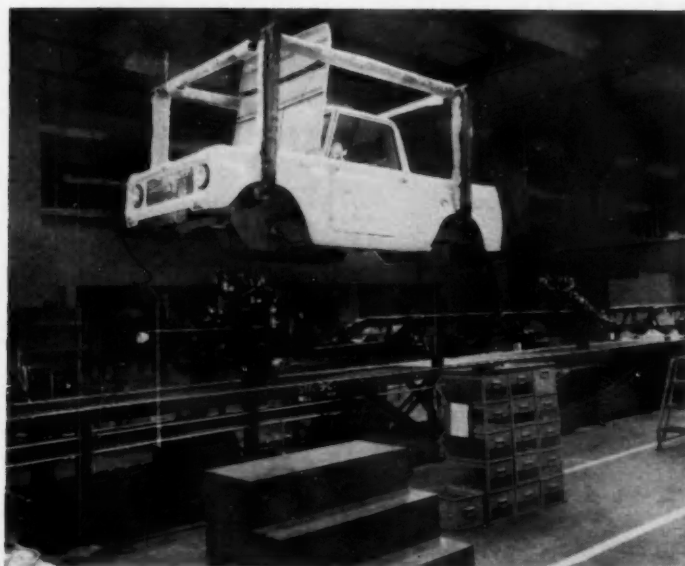
Assembly begins at the lower right. Since the chassis frames are custom-made to the fleet operator's specifications, side rails are cut to length and drilled for fastenings

in the small building—Building 109—seen at the extreme right. Rails and cross members are delivered according to schedule to the frame conveyor. There are two framing lines with a total length of some 300 ft. It is of interest that frames for the DC 405 Diesels are assembled by means of bolted fastenings rather than rivets.

Axle and suspension assemblies are prepared on a separate assembly conveyor and are installed in the chassis frame in a special fixture, then rolled onto the final assembly floor conveyor. Meanwhile, the Diesel engines received from outside suppliers are placed on the dress-up line for finishing operations and installation of accessories and are delivered to the chassis by an overhead hoist.

A noteworthy feature of the heavy duty final assembly conveyor may be noted from the floor plan. The line consists of two separate branches—one for the chassis assembly mentioned above, the other for final assembly operations. Since this line has a developed length of 740 ft, there was no room for a straight run of conveyor. The problem of transferring the chassis from one branch to the other was neatly solved by introducing a 180-deg arc at the left, using a diameter of 47 ft. This arc is ample for moving the long chassis around the bend. *(Cont'd next page)*

SCOUT BODY DROP, FINAL ASSEMBLY LINE



SCOUTS LEAVING FINAL ASSEMBLY LINE



OPERATIONS ON HEAVY DUTY VEHICLES

Top—
In the heavy duty assembly department. Directly in the foreground is the start of the first branch of the HD final assembly line. This is the chassis line. To the left of this line may be seen the massive rolling fixtures on which the chassis assembly is built up before delivery to the assembly line. Axle assembly may be seen dimly at the extreme left.

Middle—
View of the transfer from the chassis line to the final run of the assembly conveyor with the 180-deg bend in the floor conveyor in the foreground. Body drop takes place after the chassis has started on the straight section of the final line. The helical coil at the left is another of the flexible air line connections for air tools.

Bottom—
Perspective of the HD assembly line with finished vehicles coming off the line in the foreground.

After the chassis has entered the upper line the cab is delivered to the body drop station by means of an overhead-mounted hoist.

One of the distinguishing features of the cab paint department is a large radiant tube, infra-red drying oven, fitted with quartz tubes. Since the efficiency of the side wall reflectors deteriorates with use because of oxidation and dirt, Harvester has equipped this booth with Weltronic controls which can be adjusted to provide increased tube intensity as required. Such adjustments are employed continuously until it becomes necessary to clean the reflectors.

It may be noted in passing that all of the conveyor systems, including some 4000 ft of overhead feeder conveyors, were installed by Jervis B. Webb. All sheet metal structures, including paint booths and drying ovens, were installed by R. C. Mahon.

Finally, it may be noted that the plant includes a group of 55 welding guns; 10 pedestal welders; and an array of some 300 air tools. The latter are employed for all assembly operations—making up fastenings on the trim lines and assembly lines. ■



START OF HEAVY DUTY FINAL ASSEMBLY LINE



TRANSFER FROM CHASSIS LINE TO ASSEMBLY CONVEYOR

TRUCKS LEAVING HEAVY DUTY ASSEMBLY LINE



AUTOMOTIVE GAS TURBINES

... THE PASSENGER CAR PROBLEM

PART III

THE best-known automotive gas turbines are the Chrysler, Fig. 1, and the General Motors, Fig. 2. Both use rotary heat-exchangers. The Chrysler unit employs a horizontal disk type; the picture shows the rather awkward ducting required. This engine has been thoroughly tested on the road, the results reported are excellent, and development work is actively pursued.

The GM turbine has been fitted to one of the corporation's futuristic cars and is presently being tested on trucks and cars. A few hand-made units have been sold as industrial power units and Allison is putting the model into limited production for the same purpose. The design is extremely ingenious.

Split drum-type rotary heat exchanger is used and both compressor driveshaft and power output shaft pass between the two halves of the drum. The two turbines and the two small combustion chambers are actually inside the drum while the compressor is outside, so that the duct work is reduced to a minimum and the design is extremely compact. The small combustion chambers gave a very smelly exhaust at the beginning, but this trouble has been overcome. Also, the turbine is not very accessible. Fig. 3 shows the variation of specific fuel consumption with load in the GM turbine. The consumption is excellent, 0.55 lb/hph, corresponding to nearly 24 per cent efficiency, and remains constant on a very wide range. On the road it would give excellent mileage.

By

Dr. Pio Franco Martinuzzi

Professor of Mechanical Engineering
STEVENS INSTITUTE OF TECHNOLOGY

Ford after having experimented with a disk rotary heat-exchanger, has recently been working on a complex two-shaft unit with inter-cooling and extended-surface heat-exchanger. This cycle, usually applied to very large industrial engines, requires extremely small components. The high-pressure

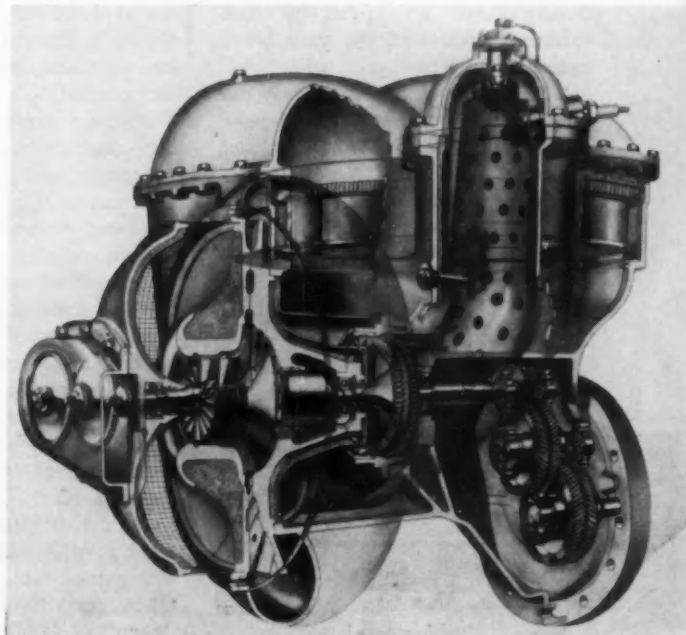
shaft turns at 90,000 rpm. It will be described in a future article dealing with truck gas turbines. There are no reliable performance data on the Ford turbine.

Conclusion

The gas turbine is already competitive with the piston engine as regards fuel consumption. It is much superior as regards acceleration and torque performance. Although American prototypes have automatic three-speed transmissions, this seems a gesture to keep the transmission engineers happy. None of the European cars built or projected uses a change-speed transmission or clutch, only a reverse is needed. Consequently the total weight (engine plus transmission) is much lower for the gas turbine and can be further reduced. A 250 hp gas turbine for general use for the Armed Forces weighs 90 lb!

There are secondary advantages and disadvantages in automotive gas turbines but they are not decisive. In a standing start there is a small lag, one or two seconds, before the car gets away because the compressor turbine must get to full speed to get full power. This is disconcerting to a driver, though

FIG. 1
The Chrysler
automotive
gas turbine



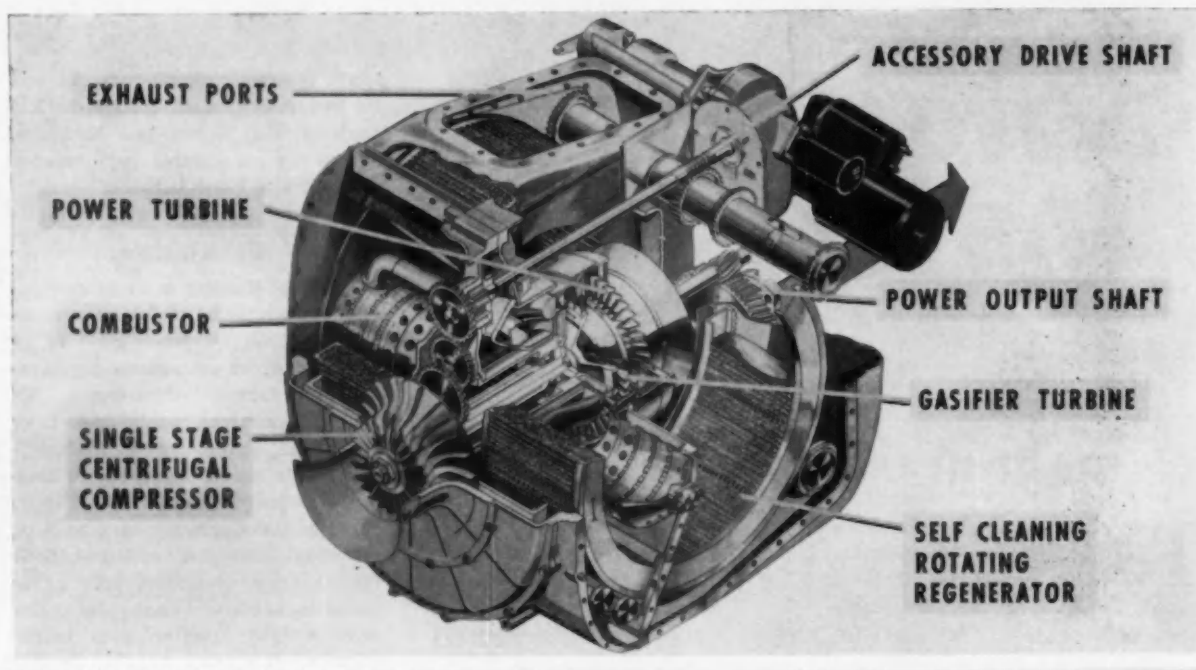


FIG. 2
General Motors' Allison GMT-305 gas turbine engine

not noticeable to the passengers, as the acceleration, once started, is superb. There are also ways to overcome this inconvenience. A split-shaft gas turbine does not give any engine braking; this defect can be overcome too. On the other hand, the gas turbine starts very easily in all weathers, has no water to freeze and, if properly designed, has an extremely clean exhaust because of the very large excess of air.

The points which will finally decide the future of the passenger car gas turbine are two: cost and safety.

As regards cost, the gas turbine

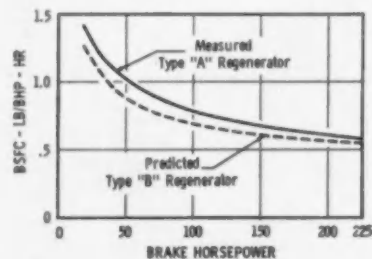


FIG. 3
Performance of the Allison gas turbine engine

is inherently simpler and lighter; it should cost less. If two new designs were started from scratch, the gas turbine prototype would be cheaper. But, as things are today, large quantity production gives a tremendous advantage to conventional engines. Some turbine parts, such as blades and disks, must stand very high temperatures and are made of very expensive metals. Owing to the very high speeds, 30,000 rpm and more, high precision and perfect balancing are required. For many parts there is no quantity production experience. However, it is probable that production engineers, if given enough incentive and money for tooling, could reduce costs to competitive figures if assured of very large quantities. Detroit firms are looking keenly at the problem of reducing turbine costs; Ford has done some interesting work on the subject. The question is: low costs imply high production, but who can assure that a radically new car will sell in large quantities?

As for safety, the gas turbine is very reliable and, with comparable experience, has much lower maintenance costs than the piston engine; there are fewer parts, no rubbing

and no periodic forces. The lower maintenance of the gas turbine is proved by aircraft experience and by the very successful Union Pacific turbine locomotives.

The adoption of the gas turbine for a large production car is a terrific gamble. If unsuccessful, it could sink all but the two largest firms; if really successful, the rewards would be colossal, as 60 million piston engine cars would be rendered obsolete. Such a gamble seems only justified if a large manufacturer should be in bad financial straits and had little to lose. There are small chances in the near future of a gradual introduction of the gas turbine in small production luxury cars, American or foreign. Unless produced in very large quantities, the gas turbine would be too expensive; in Europe it would be further handicapped by the expensive fuel.

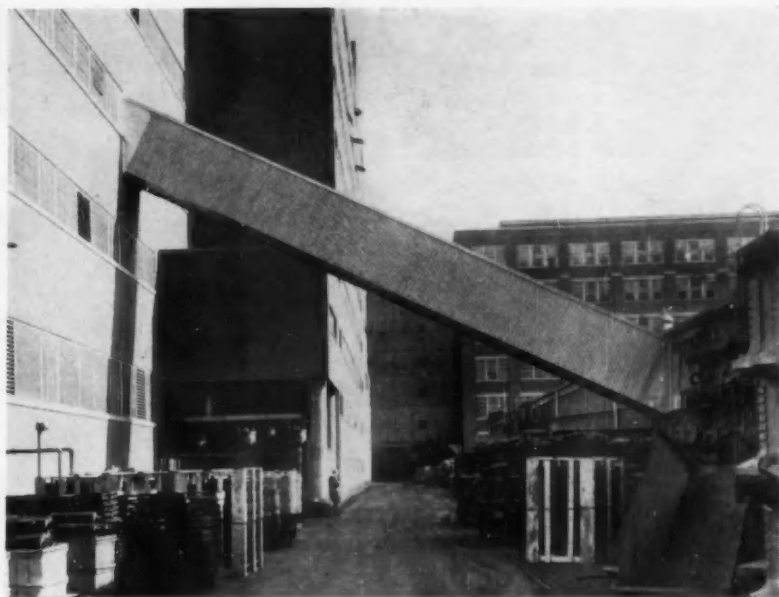
Any doubt about the eventual use of automotive gas turbines is limited to passenger cars. There is no doubt at all that gas turbines are coming, and coming soon, in trucks, buses and heavy vehicles. ■

The foregoing is the final part of a three-part article by Dr. Pio Franco Martinuzzi

An enclosed conveyor transports parts from a one-story machining department to the multi-story assembly building.

PART I

Deere's Waterloo Works Redesigns Plant Facilities



REDSIGN of the John Deere tractor line, with the change from the two-cylinder to the more versatile four- and six-cylinder power plants, brought the need for a complete replanning of production facilities at Deere's Waterloo Tractor Works. This included not only the setting up of new production lines in all departments, with heavy outlay for 465 new machine tools, but a redesign of the basic flow of material through the plant. Complicating this study of plant layout was the fact that the Waterloo Works was committed to a multi-story plant already in existence.

The basic nature of the change in flow of material made necessary by tractor redesign is shown by some consideration of features of the old model tractor. The two-cylinder horizontal engine had its short crankshaft positioned transversely across the tractor axis. The transmission, crankshaft, and differential were housed together in one casting. While this system provided a power train in a minimum of space, it also made necessary the building of the tractor from

By Kenneth Rose
MID-WEST EDITOR

basic parts on the assembly line. Engine and transmission were built there, rather than being swung in as subassemblies already practically complete. Housings enclosed several functional units.

In the new design, the four- or six-cylinder engine in upright position drives a synchro-mesh transmission housed together with the differential. These are produced as subassemblies.

It was this change in basic flow of materials, from a components-to-assembly-line system to a components - to - subassemblies - to - assemblies-line operation, that made necessary sweeping changes in plant layout. The main buildings of the group were six-story structures, dating from 1953 only, so that the new plant layout was required to be made within the pattern of these buildings.

There are five of these six-story buildings, located as a group, and a sixth is under construction. In addition, there are several one-

story buildings, including a gray iron and nonferrous foundry with a pouring capacity of 1000 tons of gray iron per day. Other one-story buildings house the heat-treat department, and several machining departments. Total floor space is about 3.4 million sq ft.

In the overall planning for flow of material, it was decided to retain the central building of the six-story group as an assembly building, with the main assembly lines on the first floor, and subassemblies on the upper floors. Each floor level above the first in each of the remaining four buildings is joined to the corresponding level in the assembly building by enclosed ramps. In addition, there are mono-rail conveyor lines joining several of the one-story buildings to the six-story group.

In planning production facilities, space allotment had to take into consideration two additional factors. One was the loadbearing capacity of the floors, and the other was the floor-to-ceiling height. The first floor received first priority choices as having the greatest loadbearing capacity, and the sixth floor was given second priority allocations as having the greatest ceiling height.

The layout finally arrived at, provided for the main assembly lines on the first floor of the assembly

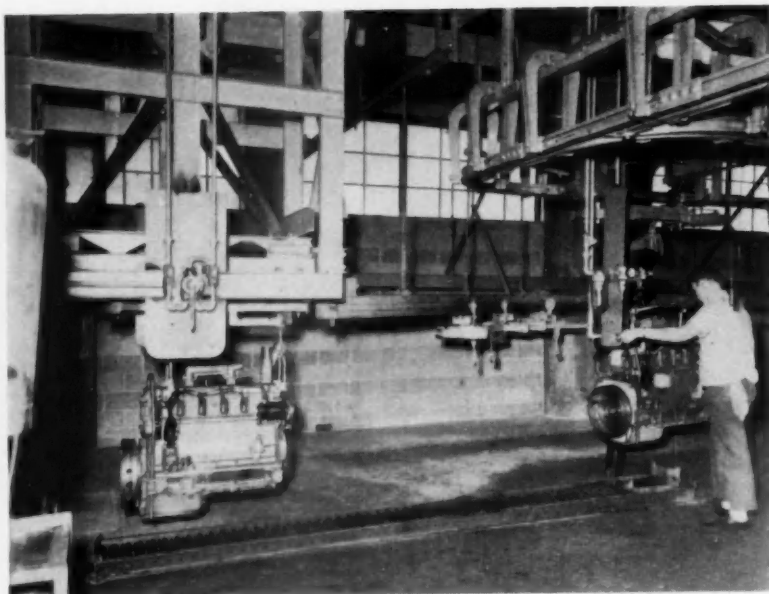
building, with subassemblies feeding down to it from the upper floors. Hitch parts, produced in an adjacent one-story building, move to the assembly line on trucks after the assemblies have been painted. Transmission case and clutch housing machining departments also are located on the first floor of the assembly building, and several miscellaneous departments, such as tool grinding and cleaning after heat treat, are located in other buildings on the first floor level. In addition to the heat treat departments already mentioned, heavy gears, such as the final drive gears and spiral bevel drive gears, are cut in first floor departments.

On the second floor of the assembly building the transmissions are assembled. Other operations on the second floor level of other buildings are the machining of miscellaneous transmission parts, small bevel gear cutting, including shaft gears and cam shafts, spur gear machining, and gear grinding as a finishing operation. These parts are trucked across the ramps to the assembly building.

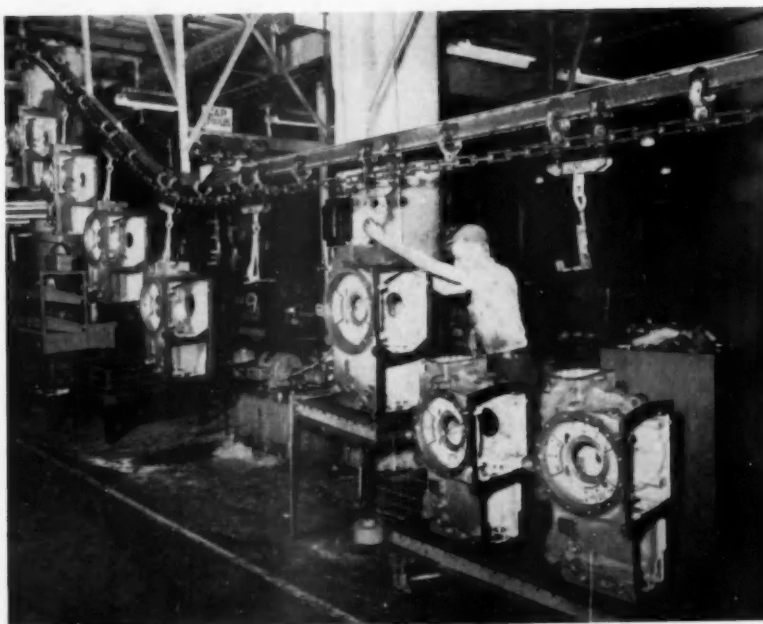
The third floor of the assembly building houses the fabrication of small sheet metal parts. On this level in other buildings are located the tool room, the stock room, the factory machine maintenance department, and the helical gear machining department. The gears from this last-named department go to heat treat on overhead conveyors, then to the second floor for finish grinding, and are then trucked across ramps to the transmission assembly area.

Hydraulic subassemblies are made up on the fourth floor of the assembly building. Machining on hydraulic unit parts is done in three departments on the fourth floor level in the adjoining buildings. Two additional departments are devoted to repair parts on non-current tractor models.

The fifth and sixth floors are together devoted to the machining and subassembly of engines. On the fifth floor of the assembly building are located the engine assembly line and engine test facilities. Feeding into this from the same



A drop section in a power and free conveyor, an elevator in a monorail system, and a roller conveyor are used to transfer engines from assembly to the test room.



This overhead conveyor carries transmission cases and clutch housings from the main floor to the second floor for assembly.

level in adjoining buildings are parts from three engine parts machining departments, while two additional departments are used for the machining of small noncurrent parts in cast iron. On the sixth floor of the assembly building are located the facilities for machining connecting rows, pistons, and some hydraulic unit parts. Sixth floor level facilities in the adjoining

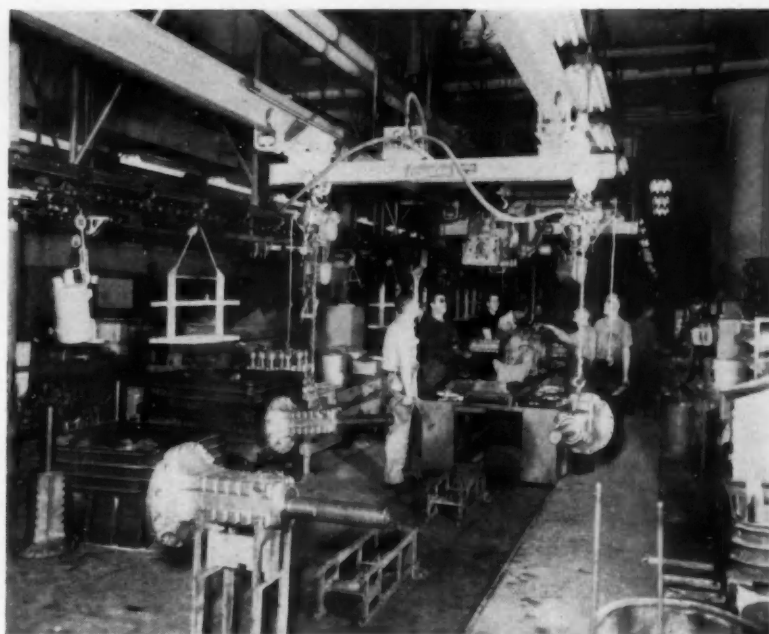
buildings provide for machining on connecting rows, pistons, cylinder sleeves, steering motors, hydraulic pump machining and miscellaneous hydraulic parts machining, bar stock machining other than the work done on automatic screw machines, and equipment for noncurrent connecting rods, pistons, cylinder blocks, and other parts.

A plating department for small parts also is located on the sixth floor level.

The cylinder block line is located in a one-story building, and the finished blocks move up to the fifth floor assembly. Crankshaft machining, rear axle housing machining, and oil pan machining are located in adjoining one-story buildings.

In order to carry the workpieces efficiently through the production lines, and then to the assembly lines, an elaborate system of conveyors has been set up in each department, and between most departments. Feeding the subassemblies from the various floors of the assembly building to the first floor involves monorail conveyors, lowerators, and chain conveyors. So well were later needs foreseen when the building was erected in 1953 that the new layout was accomplished without the need for cutting any new floor openings.

The assembly lines for the 3010 and 4010 tractors, and for the 730 model still made for export, located on the first floor of the assembly building, are floor slat conveyors in steel, with upright support brackets



At the start of the main assembly line, mounted on steel slats, the transmission is conveyed from the second floor on a monorail.

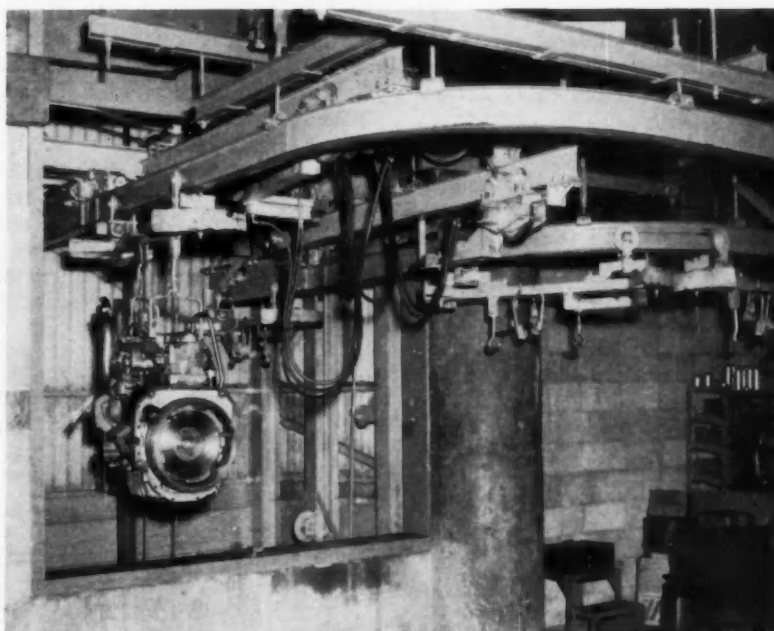
bolted to them. The engine and transmission, heavy subassemblies, are dropped on lowerators from the second floor onto the moving tractor line. The engines move from the fifth floor to the second floor on an automatic elevator, built out-

side the building wall, to continue to the first floor on the lowerator. At the beginning of the assembly line there exists a three level materials handling arrangement—one above another—the slat conveyor on the floor, a bridge crane overhead, and a monorail suspended from the ceiling.

A feeder conveyor travels from the fourth floor, through the third floor, and to the first floor with hydraulic subassemblies. On the third floor it picks up sheet metal subassemblies also. Miscellaneous small parts, including hardware, oil lines, and purchased parts, move to the assembly line from storage areas. Some are stored in bins, some on flats, and some are held in containers until used.

On all of the feeder conveyors coming to the assembly line, loading is synchronized and sequenced with the routing of orders on the assembly line. Coded sequence sheets are set up each day for all the departments that feed to the assembly lines. In this way each tractor is built to the order of the customer. ■

This is Part I of a four-part article devoted to the Deere and Company Waterloo Works. Part II will appear in an early issue of AUTOMOTIVE INDUSTRIES.



A track conveyor carries engines into a lowerator shaft on the fifth floor for automatic lowering to the second floor. Empty carriers travel in the opposite direction.

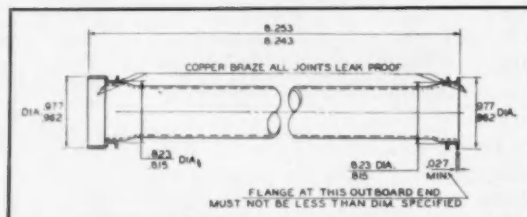
MECHANIZATION

in Push Rod Cover Fabrication

By Andrew Martin
Special Machine Designer

Rochester Products Division
GENERAL MOTORS CORP.

Tubular push rod cover for Chevrolet Corvair engines, right, with details shown in drawing above.



TUBULAR push rod covers for Chevrolet Corvair engines are among new products being fabricated on a semi-mechanized basis and in large volume by Rochester Products Division, General Motors, Rochester, N. Y. Each such cover consists of an 8-in. length of welded steel tubing of 0.875 in. OD and having 0.029-in. wall thickness. To each end, a double-flanged end ring is assembled and brazed after the ends of the tube have been expanded for press fit into the ring bores. Following the brazing operation, all assemblies are pressure tested for leaks. In service, the tubes carry lubricant, any leakage of which must be avoided.

Tubing is formed from strip stock and the longitudinal seam is resistance welded in a continuous standard machine employed in the same plant. Sixteen ft lengths cut off at this machine are delivered to the setup, Fig. 1, where they are

placed, many at a time in an automatic bar feed loader. From this loader, each tube is fed to a hydraulically operated cutoff knife.

Each time the long length is advanced to a stop, through a cutoff sleeve die, a limit switch is tripped. This causes the dies to clamp the tube, after which the cutoff knife is lowered to sever the required short length from the long tube. This flat knife has a sharp point at its center, made by grinding long radii at each side, and is 1/16 in. thick.

As the knife is lowered, the point first dents the tube wall at the top and then the knife edges cleanly shear out a ring of metal 1/16 in. wide, severing the required short length, which is released as the knife is retracted. With this type of knife, only slight, if any, burrs remain and a square end results. An inward dent is left, however, at each end of each short length cut.

Tubes feed from the cut-off into an inclined magazine. At its lower end is a vertical slide timed to load one tube into the jaws of each pallet or fixture when it is indexed into position below the slide. Indexing motion is at right angles to the short tube axes. Each half of each fixture jaw has two ball detents backed by springs and, when the slide pushes a length of tubing into the jaws, the detents are depressed and grip the tube.

There are 56 holding fixtures on the chain and all move forward at each indexing until, as each fixture starts to move around the sprocket at the discharge point in the chain loop, the tubes engage a fork that lifts them out of fixture jaws. Fixtures are indexed positively but are held by springs and studs arranged to give them a limited float. At the end of each index, however, the tubes are clamped precisely so they always come into line with tools

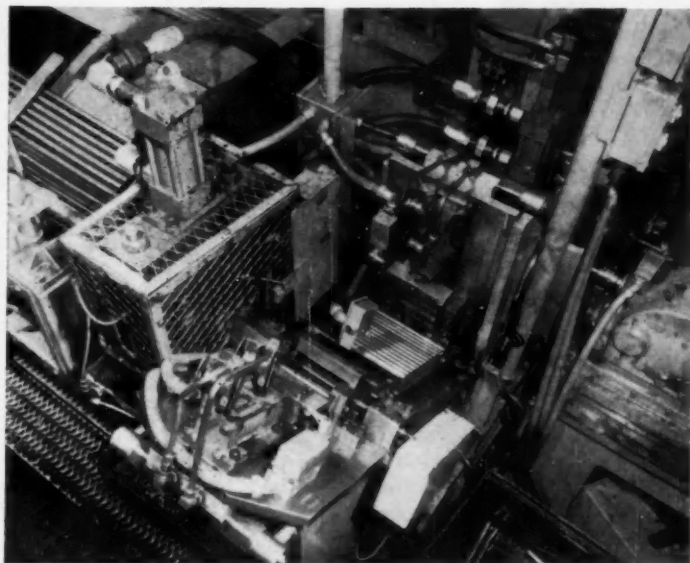


Fig. 1—Start of the mechanized line for processing short welded steel tubes cut from long lengths by a knife inside the cage. Each length is discharged into the inclined magazine and a slide pushes the length into an indexing fixture.

that perform end operations. When these operations are completed and fixtures are unloaded, they pass around a chain sprocket and return, at a lower level, until they move around a second sprocket back to reloading position.

At the first work station, left in Fig. 2, each fixture comes between a pair of round nosed tools that are rotated, advanced and retracted by Kingsbury heads, left in Fig. 2. In entering the ends of the tubes, these tools remove the dimples left by the cut-off knife. During indexing to the second station, one end of each tube passes over a side

Fig. 3—Station at which tube ends are sized and shaped by combined use of arbors or punches and dies. Fixture at left holds a tube whose far end has been shaped and after the fixture has been released and elevated by springs that permit floating action.

wedge face and against a flat surface that serves as a backing when a flaring punch is advanced hy-

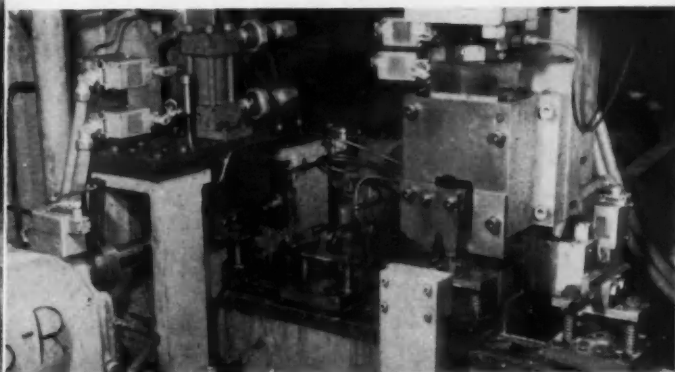
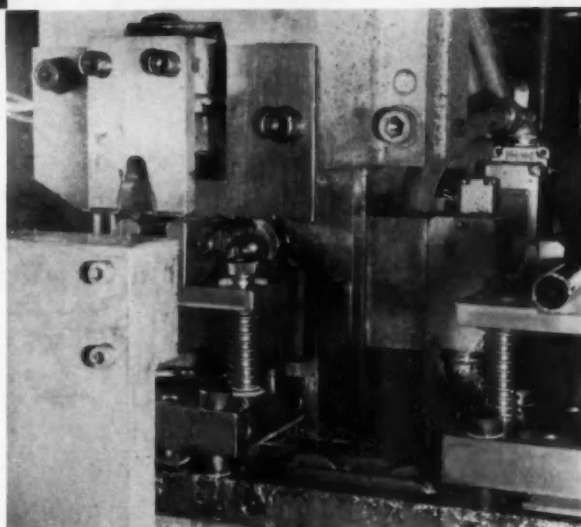


Fig. 2—Two dedimpling and sizing stations along with four indexing fixtures, each holding one tube, are shown here near the start of the processing line. Fixtures are advanced along the track by a continuous chain.



draulically into the opposite end, right in Fig. 2.

This punch projects through a die hole that is smaller than the outer portion of the flared end produced. When this die, left in Fig. 3, is moved outward, the flared end is drawn down to die hole diameter over a short length. Thus, at the end of these tool motions, the tube has a short expanded cylindrical end joined to the original tube wall by a taper. The expanded end is sized in this manner to fit the ring applied subsequently.

Following indexing to the third work station, the expanded tube is backed by a flat block and the second end is expanded and drawn back in the same manner as the first one. This leaves the tube with

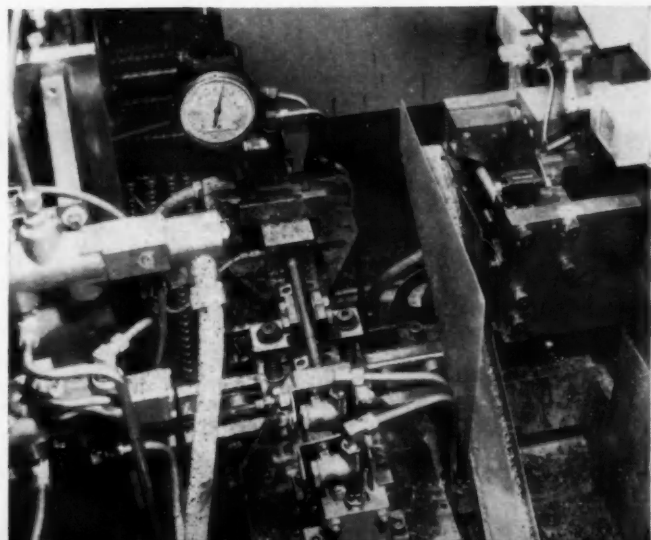
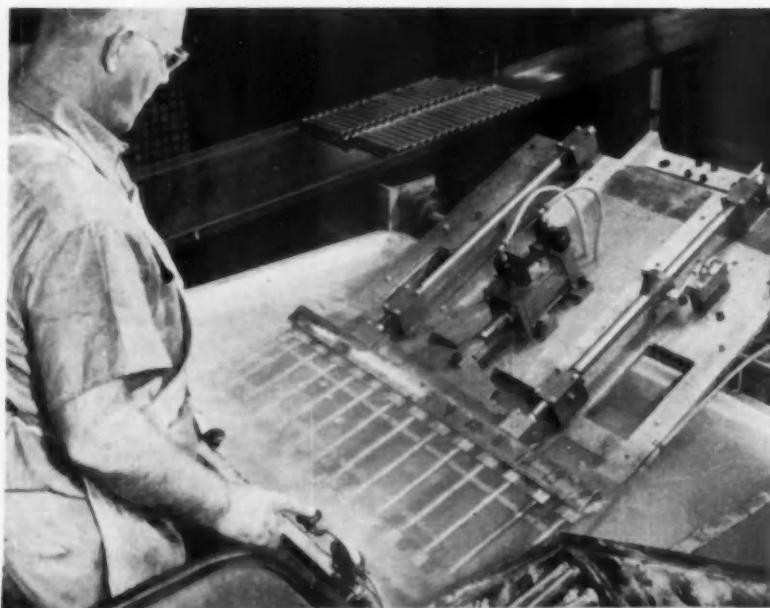
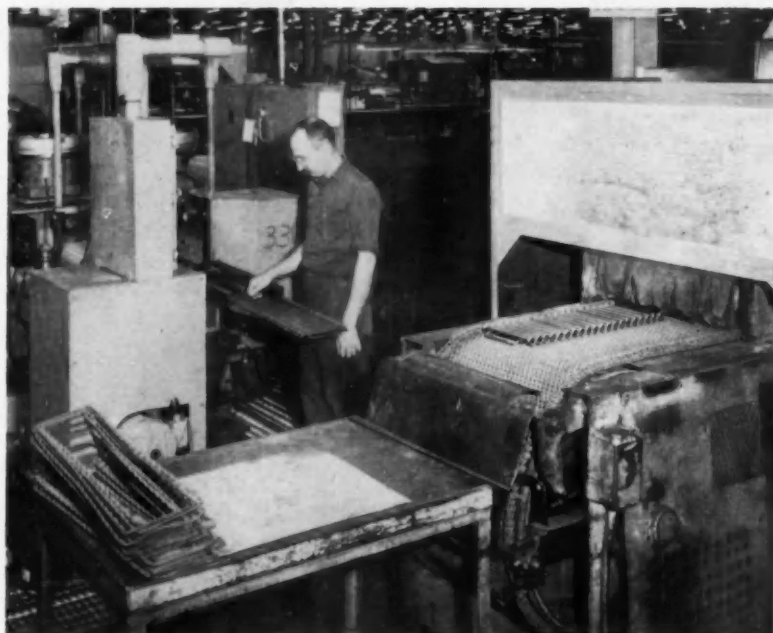
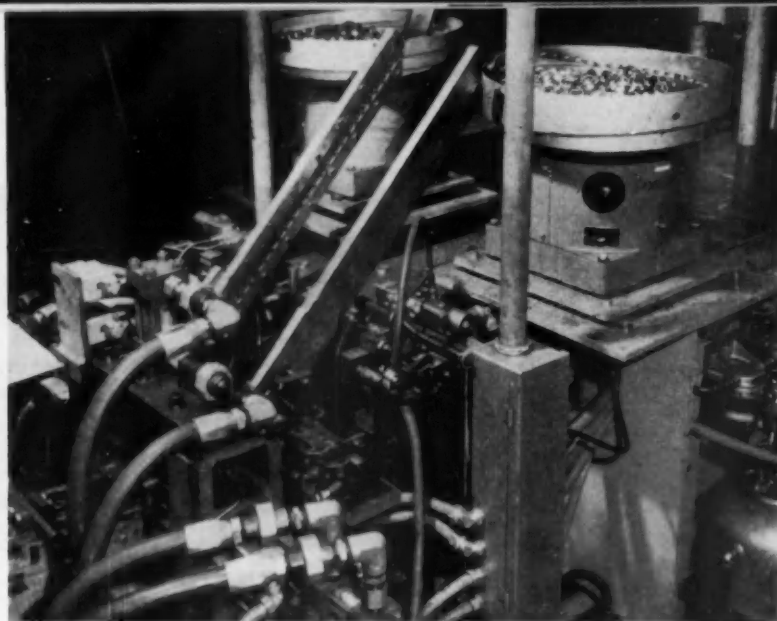


Fig. 4—In this station, each formed tube is sealed at ends and is filled with air at 20 psi to test for leaks. If the gage hand falls, indicating a leak, the tube is ejected automatically at the next station and is scrapped.



both ends expanded and ready (after end chamfering and brushing) to receive rings. These are double-flanged stampings whose bores are sized to make a press fit over the expanded tube ends.

In the fourth station, a rotary tool is advanced to chamfer both the OD and ID at one expanded end. This same operation is repeated on the second end at the fifth station. Then, at station 6, a wire brush is fed through the whole length of the bore to remove any fins, burrs or scale, leaving the interior clean. After advance to the seventh station, Fig. 4, both ends of the tube are sealed by the advance of rubber tipped plungers. Then, air at 20 psi pressure is admitted, as shown by a gage. If, when the air supply is cut off, there is a pressure drop indicating a leak, the assembly is ejected automatically after the next index. This precludes further operation on leakers, which are scrapped.

The tubes are washed prior to paste application and ring assembly. The fixture is indexed through a short tunnel washing unit to remove any oil, grease, chips or foreign matter. When the tubes, still in their fixtures, issue from the washer they enter the ninth work station of the conveyor. At this station there is, just inside each ring, a gun carrying a brazing mixture in heavy paste or semi-solid form. Each of these air operated guns deposits a small amount of this mixture against the tube next to an inner flange ring.

(Turn to page 64, please)

TOP—

Fig. 5—End rings, fed from hoppers via magazines, are pressed onto each end of each formed tube after it is indexed into this station. A tube with rings in place appears at lower left, still in its holding fixture.

MIDDLE—

Fig. 6—Tubes ready for brazing issue from the assembly conveyor, background, and are set by hand in light fixtures that then are placed on the wire mesh belt of the electric brazing furnace, right.

BOTTOM—

Fig. 7—After brazing, tubes are loaded by hand and clamped in the dunking fixture here shown and are tested under air pressure for leaks.

Plastics

in the **AUTOMOTIVE INDUSTRIES**

... PART I ... **NYLON**

PLASTICS enjoy first-class citizenship among materials. The image of cheap products, easily made and easily broken, was dissipated long ago by the hard fact that plastics can answer a great many design questions that previously have been without answers.

The reason: a wide range of physical properties is obtainable "by prescription." As man-made materials, they can be chemically altered and "bred" for the job.

In a market where defect means defeat, the plastics industry, with force and cohesion, has emerged as a \$3 billion-a-year business that produced a new high of some 6.2 billion lb in 1960. This represents a three per cent increase over 1959 totals.

Automotive uses have moved from about 11 lb per car in 1954 to over 25 lb in today's automobile. Although the long climb to reach autodom's subtreasuries has been slowed by the high costs of resins, material suppliers and fabricators are minding their pennies in a strong bid to bring prices down. One of the most recent—Du Pont's promising youngster Delrin acetal—down 15¢, from 80 to 65¢ per lb.

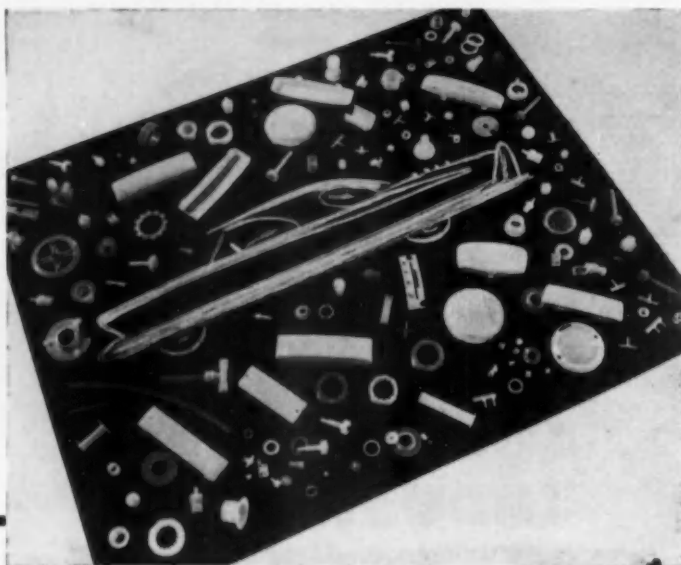
Perhaps the biggest spur to increased usage has come from tough prosperity. In becoming increasingly choosy about its purchases, more wary about high hopes and great promises, and more disenchanted with such concepts as planned obsolescence, the car-makers have moved quietly toward plastics on the basis of their increased performance at equal or less cost.

Originally researched and developed by du Pont's W. H. Carothers, nylon was introduced to the public in the form of tooth-brush bristles and hosiery fiber. Its inherent properties such as strength, durability, low coefficient of friction, and resistance to chemicals and heat made it quickly apparent that a great com-

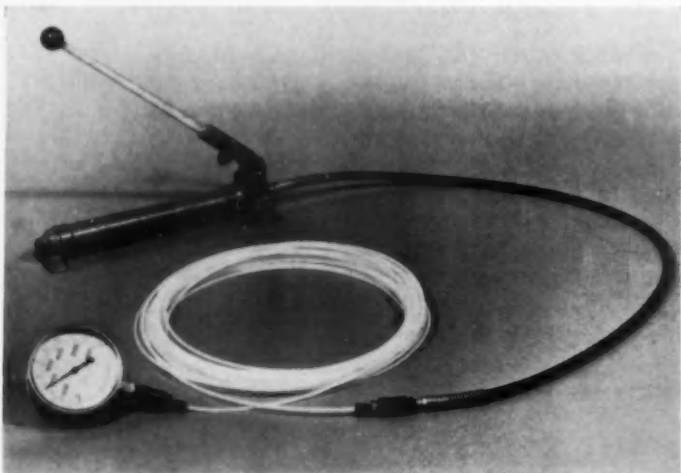
mercial potential existed. Today, as a well-established engineering material, its name has a special ring; its versatility has left an indelible message.

Nylon is the generic term for a family of polyamide resins, all of which are related, but not identical in chemical composition. It is made by the reaction and union

By
Norman M. Lloyd
MARKETS EDITOR



Nylon's toughness, durability and lubricity have made it a highly versatile engineering material. Decorative and functional uses total over 250 in today's automobile (Du Pont).



Tough and flexible automotive tubing made of nylon eliminates pre-shaping. Zytel tubing has a burst pressure above 2500 psig (Du Pont).



Windshield Wiper Cam
Windshield Wiper Gear
Speedometer Worm Gears
Heater Control Slide Bushing
Heater Control Linkage
Mirror Socket Bushing
Mirror Flipper
Fuse Holders

Dome Lamp Lenses
Sealed Beam Unit Lock Nuts
Lamp Sockets
Solenoid Insulators
Generator Insulators
Fuse Block Covers
Push Button Covers
Starter Motor Insulator
Rotor for Headlight Foot Dimmer
Horn Ring Insulators
Motor Commutator End Plate
Distributor Plate Separator

Vacuum Check Valve Seat
Vacuum Spark Advance Tubing
Restrictor
Carburetor Cams
Carburetor Filters
Mirror Case Back
Coat Hooks
Nuts, Clips, Plugs
Piston Rings, Power Steering Units
Battery Cables
Door Handle
Heater Chute

of simple molecules, called monomers, to form a chain-like chemical structure known as a polymer. By varying the choice of monomers, the extent or degree of reaction (polymerization), and the mixing or alloying with other compounds, a wide assortment of nylons can be produced. Some are more useful as molding powders, some as textile fibers, some as monofilaments, and some as surface coatings.

Although nylon fiber plays a major role in upholstery and tire cord, the most widely used nylons in the automotive industry are general purpose molding and extrusion types—nylons 6,6 nylon 6, and to a lesser degree, nylon 6,10.

Special formulations of these types also are available that differ primarily in heat, weather and hydrolysis resistance, and viscosity in the molten state. Other modifications offer a wide range of

Gears for speedometers, windshield wipers, radio antennas, and other parts molded from Zytel nylon. Quiet running, durable, and with extremely good frictional properties, nylon has become big seller for gears

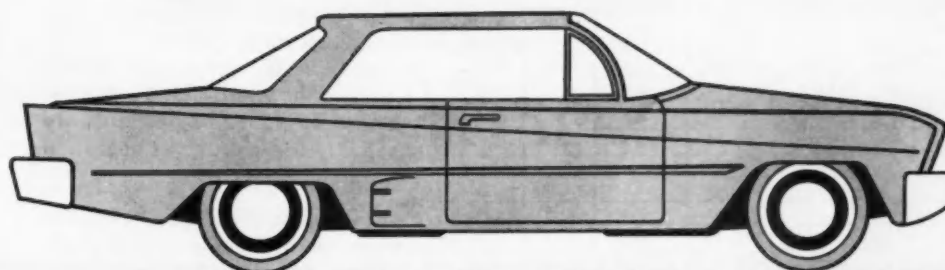
Distributor Cable Holder
Retainer Rings
Courtesy Light Switch Housings
Wire Clips and Connectors
Push-Button Control Collector Rings
Push-Button Control Contact Cams
Voltage Regulator Bases
Window Regulator Switch Handle

Switch Control Cam
Radio-Touch-Tuning Bar
Window Regulator Gear
Window Crank Knob Bushing
Window Crank Handle Bearing Plate
Window Regulator Rollers
Window Regulator Anti-Rattle Plate
Window Slides

Lock Control Bushing
Door Hinge Bushing
Door Weatherstrip Flipper
Front Seat Back Stop
Door Check Slide Block
Door Latch Wedge
Truck Lock Wedge
Tubing for Pneumatic Window Regulators

Brake Pedal Bushing
Brake Hub Spring Insulator Bushing
Brake Linkage Bushing
Master Brake Cylinder Push Rod Bushing
Center Link Bushing
Upper Steering Column Bushing
Tire Valve Caps
Tubing for Automatic Lubrication Systems

Tubing for Air Suspension Systems
Air Suspension Levelling Valve
Upper Steering Column Bushing
Brake Cable Liner
Window-Crank Handle Bearing Plates
Cable Clips
Fuel Filter Housing
Oil Slinger
Body Wiring Harness
Insulation for Voltage Reg. Base
Vacuum Controlled Electrical Switch
Lamp Socket



... AUTOMOTIVE APPLICATIONS FOR NYLON ...

Air Filter
Oil Filter
Accelerator Link
Main Hanger Bushing for truck semi-trailer
Brake Camshaft Bushing
Center Link Bushing
Idle Arm Bearing
Clutch Linkage Bushing
Outlet Nut Windshield Washer
Foot Pump
Windshield Washer Valve

Windshield Washer T-Connection
Rod and Gear for Antenna Elevating Device
Oil Pan Drain Plug Gasket
Tubing for Vacuum Spark Plug Line
Speedometer Driving Gear
Speedometer Take-Off Gear
Clutch Pedal Bushing
Tire Cord
Upholstery Fiber
Fuel Lines

Radiator Overflow Tubing
Air Conditioner Refrigerant Tubing
Rotary and Push-Pull Cable Casings
Clutch Facings
Flexible Coupling Links
Electrical Connectors
Check Valves
Lamp Sockets
Valve Seats, Inlet and Exhaust Valves, Air Suspension System
Self-Tapping Screws
Steering Column Bearing

Shaft Seals
Timing Gears
Mirror Housings
Clutch Cross-Shaft Bearing
Auto, Transmission Selector Level
Main Hanger Bushings, Torsion Bar
Shackle Bushings, Torsion Bar
Coil Forms
Fuse Holder
Battery Handle
Wire Bundle Support
Terminal Blocks

melt points, stiffness, hardness and transparency. These are tailored to satisfy the many "outside" applications that require such bonuses as higher viscosities, greater flexural and impact strength, more consistent crystallinity and improved resistance to heat, light and moisture.

For the technically-equipped reader, the chemical recipes of the most common grades are:

nylon 6, 6
condensation of hexamethylene-diamine and adipic acid

nylon 6
polymerization of episolon caprolactam

nylon 6, 10
condensation of hexamethylene-diamine and sebacic acid

Much interest has been reported in nylon 11. This type, although resembling 6,6 and 6,10, has improved resistance to moisture and greater dimensional stability at high humidities.

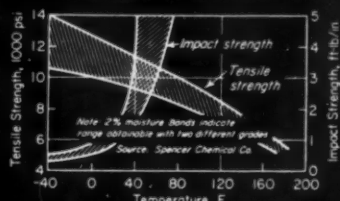
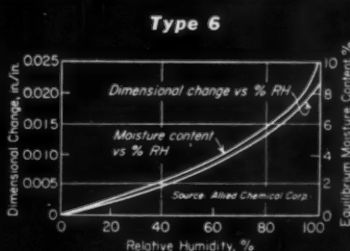
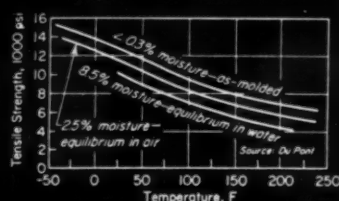
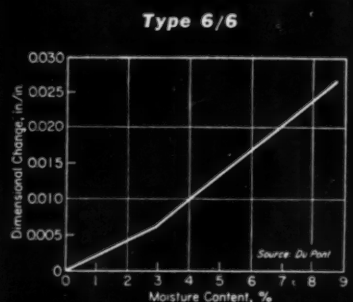
As with all nylons, these grades are thermoplastics—they melt at elevated temperatures and resolidify on cooling. They can be reheated and reshaped a number of times. In this, thermoplastics differ from thermosetting resins, which solidify on heating and cannot be remelted.

Properties

Nylon's resistance to heat is superior to that of any other thermoplastic resin. The much-used automotive molding compounds are crystalline materials that have relatively sharp melting points below which they remain rigid (although with decreasing stiffness as the melting point is approached). Above their melting points

Courtesy, MATERIALS IN DESIGN ENGINEERING

EFFECTS OF MOISTURE AND TEMPERATURE ON ...



MECHANICAL PROPERTIES OF REINFORCED NYLAFIL

PROPERTY	UNIT	AUTM TEST	G1 TYPE 66	G1 (MS) [®] TYPE 66	G3 TYPE 6
1 Tensile Strength @ -40°F	PSI	D638-58T	20,840		23,130
2 Tensile Strength @ 73°F	PSI	D638-58T	19,130	20,000	21,950
3 Tensile Strength @ 170°F	PSI	D638-58T	18,670		16,670
4 Elongation @ -40°F	%	D638-58T	1.9%		1.9%
5 Elongation @ 73°F	%	D638-58T	1.5%	1.6	2.0%
6 Elongation @ 170°F	%	D638-58T	1.9%		2.1%
7 Flexural Modulus @ -40°F	PSI	D790-58T	1,025,000		980,000
8 Flexural Modulus @ 73°F	PSI	D790-58T	985,000		970,000
9 Flexural Modulus @ 170°F	PSI	D790-58T	740,000		570,000
10 Impact Strength, Izod @ -40°F (¼" x ¼" Bars)	Ft. Lb./In.	D256-56	3.0	2.5	3.8
11 Impact Strength, Izod @ 73°F (¼" x ¼" Bars)	Ft. Lb./In.	D256-56	2.5	2.2	3.6
12 Impact Strength, Izod @ 73°F (½" x ½" Bars)	Ft. Lb./In.	D256-56	2.1		2.8
13 Compressive Strength	PSI	D695-54	16,000	21,000	15,700
14 Flexural Strength	PSI	D790-58T	22,000	23,000	21,000
15 Shear Strength	PSI	D732-46	12,000	12,000	11,500
16 Hardness, Rockwell	-	D785-51	M100	M105	M96
17 Deformation Under Load ⁽¹⁾ @ 4000 PSI	%	D621-51	0.6%	0.35	1.1%
18 Water Absorption in 24 Hours	%	D570-57T	0.7%	0.7%	1.4%
19 Water Absorption to Saturation	%		5.65%	4.51%	6.4%
20 Specific Gravity	-	D792-57T	1.36	1.41	1.34
21 Mold Shrinkage in 1/8" Av. Section	In./In.	--	.0025		.0015
22 Mold Shrinkage in 1/4" Av. Section	In./In.	--	.003		.0015
23 Mold Shrinkage in 1/2" Av. Section	In./In.	--	.004		.002
24 Taber Abrasion, CS-17 Wheel, 1,000 G	MG./1000 cycles	D1044-56	25		14

Courtesy, FIBERFIL, INC.

PROPERTIES OF ZYTEL 101, 31

PROPERTY	UNITS	METHOD	6, 6 "ZYTEL" 101*		6, 10 "ZYTEL" 31*	
			0.2% Water	2.5% Water	0.2% Water	1.5 Water
Tensile Strength, -40 °F.	lb./sq. in.	D-638-52T	15,700	13,500	12,000	12,100
73 °F.	lb./sq. in.	D-638-52T	11,800	11,200	8,500	7,100
170 °F.	lb./sq. in.	D-638-52T	9,000		5,300	
Yield Stress, 73 °F.	lb./sq. in.	D-638-52T	11,800	8,500	8,500	7,100
Elongation, -40 °F.	%	D-638-52T	20	20	20	30
73 °F.	%	D-638-52T	60	300	85	320
170 °F.	%	D-638-52T	340		300	
Flexural Modulus, -40 °F.	lb./sq. in.	D-790-48T	470,000	500,000	320,000	370,000
73 °F.	lb./sq. in.	D-790-48T	410,000	175,000	280,000	160,000
170 °F.	lb./sq. in.	D-790-48T	190,000		70,000	
Shear Strength	lb./sq. in.	D-732-48	9,800		8,400	
Impact Strength, Izod, -40 °F.	ft. lb./in.	D-256-56	0.6	0.45		
73 °F.	ft. lb./in.	D-256-56	0.9	2.0	0.6	1.6
Compressive Stress at 1% Deformation	lb./sq. in.	D-695-54	4,900		3,000	
Apparent Modulus (4)	lb./sq. in.			100,000		90,000
Hardness, Rockwell		D-785-51	M79 R118	M59 R108	R111	
Melting Point	°F.	D-789-53T	475-495		405-425	
Coefficient of Linear Thermal Expansion per °F. (3)		D-696-44	5.5 x 10 ⁻⁵		5.5 x 10 ⁻⁵	
Thermal Conductivity	B.T.U./hr./ sq. ft./°F./in.	(1)	1.7		1.5	
Specific Heat			0.3-0.5		0.3-0.5	
Deformation Under Load, 122 °F., 2,000 lb./sq. in.	%	D-621-51	1.4		4.2	
Heat Distortion Temperature, 264 lb./sq. in.	°F.	D-648-45T	190		135	
66 lb./sq. in.	°F.	D-648-45T	360		300	
Dielectric Strength, Short Time	v./mil	D-149-55T	385		470	
Step-by-Step	v./mil	D-149-55T	340		410	
Volume Resistivity	ohm-cm	D-257-54T	4.5 x 10 ¹³		4 x 10 ¹⁴	
Dielectric Constant—60 Cycles		D-150-54T	4.0	7.6	3.9	
10 ³ Cycles		D-150-54T	3.9	6.4	3.8	
10 ⁶ Cycles		D-150-54T	3.6	3.6	3.5	
Power Factor, 60 Cycles		D-150-54T	0.014		0.04	
10 ³ Cycles		D-150-54T	0.02		0.04	
10 ⁶ Cycles		D-150-54T	0.04		0.03	
Water Absorption (24 hr.)	%	D-570-57T	1.5		0.4	
Water Absorption (Saturation)	%	D-570-57T	8		3.5	
Specific Gravity		D-792-57T	1.14		1.09	
Mold Shrinkage	in./in.		0.015		0.015	
Compression Ratio		D-392-38	2.1		2.2	
Taber Abrasion, CS-17 Wheel, 1,000 g. wt. mg./1,000 Cycles		D-1044-54T		6-8		

*—"Zytel" 103 is a heat-stabilized composition very similar in mechanical properties to "Zytel" 101. "Zytel" 33 bears a similar relationship to "Zytel" 31. "Zytel" 37X is a heat- and light-stabilized resin also related to "Zytel" 31.

Courtesy, Du PONT CO.

they are fluid, with viscosity controlled in the various grades to meet the requirements of various processing methods.

Where exposure in excess of 250 F is for extended periods of time, gradual oxidative embrittlement and discoloration become considerations. As previously noted, special heat-stabilized grades, such as du Pont's "Zytel" 103, are available for continuous operation above 250 F.

The mechanical properties of nylon have made it particularly suitable for some 200 uses in vehicles. Noted for high impact and tensile strength, it has a tough surface, a low coefficient of friction, and can be accurately molded into intricate and thin-wall sections (0.025 in.).

Possessing extremely good frictional characteristics, its performance under conditions of adverse lubrication is well known. Normally, a lube is needed only in cases where heavy loads are coupled with high speeds. Good performance has even been exhibited with such unorthodox lubricants as water, milk, and even orange juice.

Its ability to dampen vibration and reduce noise has made it a big seller for gears. Deforming slightly to absorb shock, extremely close tolerances can be eliminated and the importance of tooth form and spacing lessened. When lightly loaded at high speeds, or moderately loaded at lower speeds, nylon gears, bearings and bushings will often outwear their metal counterparts.

In comparing general properties, nylon 6,6 is somewhat more rigid with a greater resistance to heat and creep. Type 6, however, has more flexibility and higher impact strength.

Nylon 6,10, closely akin to type 6,6, has greater flexibility, but less resistance to heat and deformation.

The resistance of nylon to chemicals and solvents varies with composition. The most common automotive grades are insoluble in common organic solvents, al-

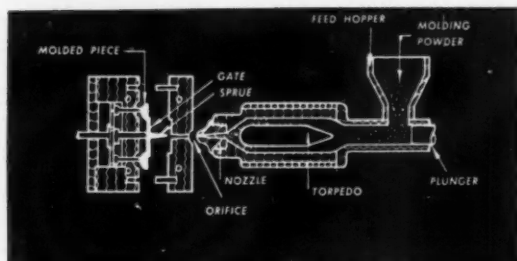


Fig. 1—Injection molding

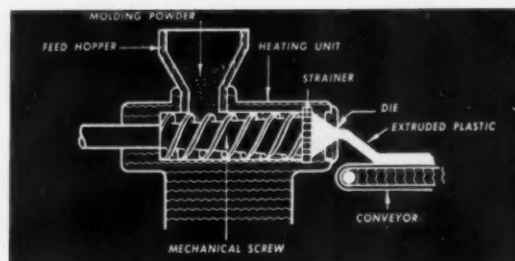


Fig. 2—Extrusion molding

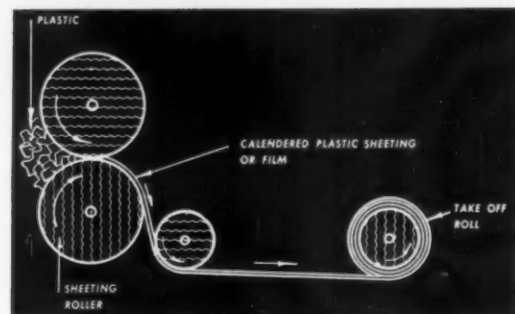
kalies, dilute mineral acids and most organic acids. They are also unaffected by petroleum oils and greases up to temperatures as high as 350 F.

All nylons may be dissolved in liquid phenols and formic acids, and they may be attacked by other than very dilute solutions of strong mineral acids.

Grades 6 and 6,6 (and to a lesser degree 6,10) are hygroscopic and sensitive to moisture. Under standard conditions, they will take on about 2.5 per cent moisture, which lowers stiffness but increases impact strength.

Electrical properties make it suitable as a general insulating material at low voltages. For high-frequency, low-loss applications, polyethylene and tetrafluoroethylene are superior. Extruded as wire and cable jacketing, nylon is widely used because of its resistance to mechanical abuse and

Fig. 3—Calendering



abrasion, chemicals and oils.

Miscellaneous properties. Natural color of molded products from various nylons is soft, ranging from light cream to amber. Special formulations are available for both black and white. Some types are translucent, or nearly transparent, in thin sections, while others are opaque.

Nylon resins burn slowly when exposed to direct flame, but are self-extinguishing when withdrawn.

Fiber

Nylon yarn is much stronger than any other textile fiber with the exception of isotactic polypropylene. It is also light (density of 1.14), nearly as strong wet as when dry, and does not support combustion. Second only to vinylidene chloride in toughness, it rates very high in tensile strength and tops all others in tenacity.

Although automotive "nylon fabrics" are, in reality, a blend of nylon and filling, yarns such as cotton and rayon, the nylon contributes to these mixtures a high tensile strength, resistance to abrasion and excellent "cleanability." Its popularity with stylists and designers stems from the infinite number of weaves, patterns, textures and colors that are possible.

As a reinforcement in tire carcasses, type 6,6 has a strength of more than 9 grams per denier. A high level of resistance to bruises, flex fatigue, heat and moisture, coupled with good high-speed durability, have made it a big seller in both the original and replacement markets.

Fabrication Processes

Injection molding, used principally for forming thermoplastics, is widely used because of the ad-

PROPERTY	UNIT	ASTM TEST METHOD	11 BCI 1100 SERIES	6,6 NYLON-GLASS BCI NYLON #6601-F
Tensile strength, 73 °F.	PSI	D-638	8,500	14,000
Ultimate elongation, 73 °F.	%	D-638	100	1.5
Modulus of elasticity, 73 °F.	PSI	D-638	185,000	1,130,000
Impact strength, Izod, 73 °F.	FT. LB./IN.	D-256	3.5	2.1
Flexural strength, 73 °F.	PSI	D-790	1.51 x 10 ⁶	23,200
Flexural modulus	PSI	D-790	80 (A Scale)	9.23 x 10 ⁵
Rockwell hardness		D-785		
Linear coefficient of expansion	°F	D-996	0.00010	
Specific heat	CAL./G./°F		0.50	
Deformation under load, 73 °F.	%			
2000 psi	%	D-621	2.02	0.12
4000 psi	%	D-621		
Heat distortion temperature	°F			
264 psi	°F	D-648	118	> 518
66 psi	°F	D-648	194	
Dielectric strength	V./MIL	D-149	425	495
Short-time	V./MIL	D-149		410
Step-by-step	OHM-CM	D-257	2 x 10 ¹³	5.2 x 10 ¹⁴
Volume resistivity				
Dielectric constant				
80 cycles		D-150		4.0
10 ⁵ cycles		D-150	3.3	3.8
10 ⁶ cycles		D-150		3.4
Power factor				
80 cycles		D-150	0.03	0.017
10 ⁵ cycles		D-150	0.03	0.020
10 ⁶ cycles		D-150	0.02	0.022
Melting point	°F	D-799	267	485-489
Water sorption	%	D-570	0.4	1.1
Specific gravity		D-792	1.04	1.32
Clarity			translucent	translucent to opaque

Courtesy, BELDING-CORTICELLI INDUSTRIES

PROPERTIES OF BCI 1100, 6601-F

vantages of high production speed, low mold cost per piece (for high unit production), little or no finishing required, small loss of material, and high thermal efficiency of the system.

A typical assembly is shown in Fig. 1. A measured amount of molding powder is fed into the machine from the hopper and forced by a ram into the heating chamber where it is softened to a fluid state. Forced at high pressure, the material passes through a nozzle or orifice into the mold cavity. Upon entering the mold, which has a temperature below the softening temperature of the molding compound, the material cools and becomes rigid. As soon as the material at the gate solidifies, the ram is retracted, the mold is opened and the piece ejected from the press.

A previously stated, nylon molding powders are hygroscopic and readily absorb moisture from the air. For this reason, it is important that moisture be held to a minimum. Moisture content above 0.28 per cent will usually result in excessive drooling at the nozzle, splay marks on the molded surface, reduced toughness and unstable dimensional properties.

Extrusion is employed to form thermoplastics into continuous sheets, films, tubes, rods, profile shapes, filaments, and coatings for wire and cable without the use of solvents.

As shown in Fig. 2, this process involves feeding granular resin into a hopper, which in turn passes it into a heating chamber. The compound is forced to the forward end of the cylinder by a continuously moving screw and driven out of the die in a molten state. The material is then generally drawn off on a conveyor or by pinch rolls and cooled by air or water. When properly cooled, the extruded nylon is wound on coils or cut to desired lengths.

For tubing, air or nitrogen under regulated pressure is supplied through a mandrel as an internal support in the extruded tube. The degree of pressure of inflation is then altered to produce a variety of diameters and wall thicknesses.

Film is extruded through a die in the form of a tube and then stretched and thinned to the desired dimensions (Fig. 3). Methods of handling the film vary, however, due to differences in the crystallinity, strength and fluidity of various grades and types of nylon.

Soluble nylons are particularly useful for coatings and adhesives. Such formulations as du Pont's "Zytel" 61 (or 63) can be dissolved in the lower alcohols such as methyl, ethyl, propyl and isopropyl, and applied in solution to wire as insulation, or to wood and metal products.

These coatings are in demand where increased toughness, higher resistance to mechanical abuse, or inertness to fats, greases or aliphatic and aromatic hydrocarbons is needed.

Nylon resins may also be dispersed, but not dissolved in, water in the form of a colloidal suspension of small particles. These dispersions can be used much the same way as solution—for the casting of film, coating, or impregnation of cloth, paper, or leather. The absence of inflammable solvents and higher viscosity make them convenient to handle.

Such specialty grades as filled, reinforced and sintered nylons enjoy limited use by the carmakers.

For such applications as bearings, sliding parts, wear pads and thrust washers, molybdenum disulfide is sometimes used as a filler to lower wear rate and improve frictional qualities. An additional bonus in the form of a lower coefficient of thermal expansion provides better dimensional stability and molding tolerances.

Sintered nylon, pressed from highly crystalline powders, is used for such parts as cams, gears, bearings, slides, rollers, etc. Although not as tough as injection molded nylon, it provides improved friction and wear properties and higher compressive strengths. Using this process, fillers such as graphite and molybdenum disulfide can be evenly and thoroughly blended.

Nylon reinforced with fiberglass

filaments is being used for windshield wiper bushings, bearings, cages, separators and has replaced thermosetting compounds in distributor cam followers. Glass-filled nylons provide substantial improvements in environmental stability and strength over unreinforced resins.

What's Ahead

New uses for nylon in cars will not come from any adventurous jump by automotive designers and engineers. Its preference over other materials will continue to be measured on the basis of performance and cost.

More hunting and homework is also needed to upgrade nylon's resistance to oxidation, heat, light and moisture. Large moldings still are up for grabs.

Nylon 11, as previously mentioned, looks promising. Although possessing low moisture absorption and greater dimensional stability, its real commercial significance may rest with the fact that it is derived from castor oil—a renewable agricultural product, and not dependent upon mineral sources.

Unpublicized work in the field of nylon alloys (combinations with epoxies and phenolics) is expected to produce super-tough and highly resistant resins for structural uses, tools, adhesives and coatings.

Look for nylon to move into automotive tubing and hose where flexural and fatigue strength, corrosion resistance and toughness are required. Fuel lines, reinforced brake hose and air conditioner refrigerant lines are logical end uses.

The recent development of hydrolysis-resistant grades (such as Zytel FE 2281) with a tolerance for liquids is expected to spur acceptance in radiator reserve tanks, radiator overflow lines, fuel tanks and filler necks and caps.

Other "choice cuts" of the market that nylon producers would like to fatten up on include such items as fans, oil pumps, timing gears, thermostat housings, heater valve components, fluidized coatings for chassis components, colored wheel disks and thrust washers. ■



Auxiliary propelled 155mm howitzer with two Continental engines

Auxiliary Propelled Howitzer Has Hydrostatic Drive

THE auxiliary propelled 155mm howitzer carriage, MIA2, was developed under Ordnance Project TW-107 as part of a feasibility study with American Machine and Foundry, Niles, Ill. Rock Island Arsenal provided technical supervision.

The weapon includes a propulsion system which serves to assist the prime mover when traversing weak soils and steel slopes. It is for this reason that it received the name "auxiliary propelled" rather than "self propelled." The weapon, however, does have a dual role in that it can act independently as a self-propelled weapon. Mobility is considered compatible to its 5 ton 6 x 6 cargo truck prime mover. Because of the weapon's added tractive effort, the 2½ ton 6 x 6 cargo truck can be considered for use as the prime mover.

Advantages of the auxiliary propelled weapon are: it provides added tractive effort to the prime mover when negotiating difficult terrain, it enables the elimination of the prime mover in Phase 1 airborne operations, it can be maneuvered in and out of a gun emplace-

ment readily, and it has the utility of a power source for elevating and traversing the gun tube, ramming the projectile, heating and lighting. Also, tractive effort is available to tow an ammunition trailer over less difficult terrain.

The two engines on the weapon are part of a new family of small engines which are being developed for the Corps of Engineers by the Continental Motor Corporation. This new family of engines features the standardization of parts.

Specifications for the engines are as follows: Type—horizontally opposed, overhead valve, 4 stroke, air cooled; bore and stroke—3 in. by 3 in.; number of cylinders—four; displacement—84 cu in.; rated hp—20 at 3600 rpm; maximum hp—35 at 3600 rpm; compression ratio—7 to 1.

An engine on each trail drives a variable displacement piston pump through reduction gears. High pressure fluid from the pump is transmitted through tubing on top of the trails to two variable displacement motors located adjacent to the large driving wheel.

Each of the two hand levers operated by the driver is positively linked to the wobbler or swashplate of the pump located on that trail. The central position of the hand levers puts the pumps in a neutral position, which allows the pump to idle at very low pressure, but provided positive braking of the weapon.

Moving both the hand levers forward directly increases pumping capacity, causing the weapon to move forward. The weapon speed is directly proportional to the amount the hand levers are moved. Reversing the motion of the weapon is accomplished in the same manner by moving both hand levers back from the neutral position.

Moving one hand lever forward and the other back causes the howitzer to turn. The turning speed and radius are determined by the relative positions of the hand levers.

The variable-displacement motors are used in two positions (high and low) to provide the weapon with two-shift drive. Depressing the foot pedal on the right trail causes the motors to shift to high, thereby putting the weapon into high speed motion (9 miles per hour).

The mechanical linkage between the hydraulic motors and the driving wheels can be declutched for normal towing operations. ■

News of the MACHINERY INDUSTRIES

By Charles A. Weinert

Metal Removal Solely by Use of Abrasives is Being Further Developed by Norton Co. Research. High-Speed Machining of Non-Ferrous Metals is Advocated by Onsrud

Norton Looking Into Abrasive Machining

Norton Co. reports that it has an intensive research project under way on "abrasive machining." Results of the study are expected to show economies from machining of castings and steel stock entirely with abrasive products.

The Norton study is approaching the subject from the standpoint of the equipment required, as well as the economics involved. First phase will be correlation of available information from all sources. Information thus gained will determine the areas of application which appear most promising for the second phase of the project—mechanical research into the equipment and techniques of applying abrasive machining.

Initial findings indicate that the greatest potential savings may be in the fields of flat surface machining and in slotting and grooving applications—because of the suitability of presently-available equipment. With further developments in abrasive machinery, Norton feels these savings will be extended to the area of cylindrical machining.

As Norton president, Ralph F. Gow, points out, "Just because machining of metal has always been done in a certain way, there is no assurance that traditional methods are the best that can be used. An abrasive wheel is actually a chip-making tool with an almost infinite number of cutting teeth." He added, "Modern developments in both grinding wheels and the machinery on which they are employed indicate that this is an excellent time to thoroughly examine abrasive machining as an economical method of reducing

present high costs of manufacturing."

Onsrud Recommends High-Speed Machining

At a recent press conference held in the Chicago area, officials of Onsrud Machine Works, Inc., suggested high-speed machining as the answer to low-cost milling of non-ferrous metals—aluminum and magnesium.

They talked in terms of spindle speeds from 1800 to 100,000 rpm, and cutter speeds from 5000 to 10,000 sfpm. Also about proportionately higher feed speeds to maintain a given chip load on each tooth of the cutter.

For example, a 6-in.-diam 8-tooth cutter running at 3600 rpm (5400 sfpm) needs a feed speed of 28.8 ipm to obtain a chip load of 0.001 in. per tooth. If the chip load per tooth is raised to 0.010 in., then the feed speed required is 288 ipm. It was mentioned that the maximum thickness of chip depended, of course, upon the surface condition desired, also upon the capabilities of the machine and its tooling on such factors as rigidity and power.

The Onsrud people indicated that adequate tool life in high-speed machining has not been a problem—and that, anyway, tool life should be measured by the number of pieces produced per cutter grind and by the savings in production time.

Chip-welding onto the cutter when machining aluminum should not be experienced, they stated, because of the short time of contact between chip and cutter. With high-speed machining, the cutter turns much faster (sometimes as much as 10 times faster) than with conventional speeds.

Around the Industry

E. W. Bliss Co.—consolidated 1960 net sales of the company and its subsidiaries amounted to \$86,243,375, an all-time high and a gain of 16 per cent over 1959 sales of \$74,616,100. Net income after taxes amounted to \$1,915,108, compared with \$786,843 for 1959.

Kearney & Trecker Corp.—will receive a refund of \$3,635,000 in settlement of a long dispute with the government about income and excess profits taxes paid by the company for fiscal years ending Sept. 30, 1944, and Sept. 30, 1945.

Hughes Aircraft Co.—has retrofitted, for the first time, a standard Hughes NC-200 two-axis numerical control to an RA 41P Wiedemann turret punch press. The machine is in use at the company's plant in Fullerton, Calif.

National Machine Tool Builders' Assn.—Eugene J. Koschella has joined the Association as a member of its staff. Previously with Warner & Swasey Co., he completed the W&S special apprentice program, and served in various engineering positions. Mr. Koschella has an engineering degree from the University of Texas, and a master's degree in industrial management from Western Reserve. His initial duties at NMTBA will largely consist of assignments formerly handled by Robert H. McGrath, who was voted early retirement by the board of directors.

Bartsch Tool Corp.—has scheduled a series of monthly clinics on hydraulic tracers, for management, engineering and operating personnel. Details are available by addressing the firm at 3714 Oakton St., Skokie, Ill. ■



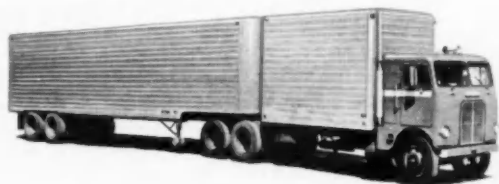
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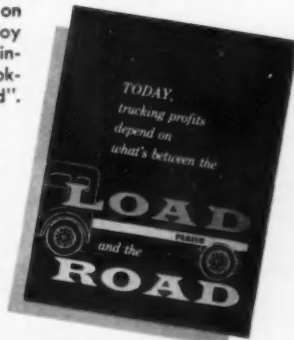
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INDUSTRY STATISTICS

By Marcus Ainsworth, STATISTICAL EDITOR

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending		Year to Date	
	March 11	March 4	1961	1960
PASSENGER CAR PRODUCTION				
Total—American Motors.....	5,045	6,820	53,353	104,435
Chrysler.....	2,108	.....	16,331	23,551
De Soto.....	.....	.....	.....	12,247
Dodge.....	3,770	.....	19,743	85,024
Imperial.....	324	.....	1,774	5,053
Lancer.....	1,267	.....	5,899	.....
Plymouth.....	4,715	.....	27,961	77,826
Valiant.....	3,239	.....	17,925	82,641
Total—Chrysler Corp.....	15,423	.....	89,634	256,342
Comet.....	2,395	1,143	19,546	8,008
Falcon.....	4,535	8,160	71,294	98,756
Ford.....	6,288	10,396	144,245	278,157
Lincoln.....	529	690	7,219	6,419
Mercury.....	3	2,393	10,087	45,299
Total—Ford Motor Co.....	13,730	31,772	258,391	437,641
Buick.....	3,919	3,624	38,184	73,842
Buick—Special.....	1,628	1,530	13,985	688
Cadillac.....	3,387	3,356	35,148	40,229
Chevrolet.....	25,035	23,629	231,845	388,205
Corvair.....	6,840	6,699	65,317	77,311
Oldsmobile.....	5,771	5,784	49,642	95,732
Olds—F86.....	1,457	1,499	14,983	.....
Pontiac.....	5,352	4,961	47,229	90,040
Tempest.....	2,447	2,308	24,725	.....
Total—General Motors Corp.....	58,636	53,990	516,761	774,359
Total—Studebaker-Packard Corp.....	1,155	24	9,514	29,986
Checker Motors.....	125	125	959	1,195
Total—Passenger Cars.....	91,314	92,332	926,612	1,603,950
TRUCK AND BUS PRODUCTION				
Chevrolet.....	6,612	6,327	59,705	108,351
G. M. C.....	1,376	1,340	13,012	25,015
Diamond T.....	35	36	281	655
Dodge.....	60	60	528	940
Dodge and Fargo.....	1,358	1,325	11,329	18,962
Ford.....	6,348	6,606	62,865	81,544
F. W. D. Corp.....	11	14	175	248
International.....	2,045	2,787	25,452	29,434
Mack.....	195	193	1,900	3,025
Studebaker.....	276	228	1,404	2,168
White.....	336	329	3,192	4,061
Willys.....	2,664	.....	18,890	25,680
Other Trucks.....	80	80	720	1,021
Total—Trucks.....	22,196	19,325	199,453	301,004
Buses.....	45	45	580	795
Total—Motor Vehicles.....	113,557	111,702	1,126,045	1,905,757

NEW FOREIGN CAR REGISTRATIONS*

JANUARY			
	1961		1960
Volkswagen.....	13,425	Volkswagen.....	11,973
Renault.....	1,760	Renault.....	6,077
Opel.....	1,024	English Ford.....	2,609
Mercedes Benz.....	792	Opel.....	2,370
Fiat.....	706	Fiat.....	1,954
Volvo.....	679	Simca.....	1,426
Standard Triumph.....	603	Vauxhall.....	1,339
Metropolitan.....	571	Hillman.....	1,165
Simca.....	568	Volvo.....	1,138
M. G.....	519	Mercedes-Benz.....	1,007
All Others.....	4,947	All Others.....	9,162
Total.....	25,594	Total.....	40,420

TRACTOR SHIPMENTS

WHEEL TYPE

Hp Ratings	January, 1961
9-34 belt hp.....	1,739
35-39 belt hp.....	2,277
40-44 belt hp.....	1,941
45-49 belt hp.....	1,830
50-59 belt hp.....	3,431
60 belt hp. and over.....	5,997
Total—Wheel Type.....	16,015 ¹

TRACKLAYING TYPE

20-89 net engine hp.....	868
90-129 net engine hp.....	478
130 net engine hp. and over.....	412
Total—Track Type.....	1,758 ²

¹—Valued at \$42,972,000

²—Valued at \$17,052,000

1961 NEW REGISTRATIONS*

Arranged in Descending Order According to the January, 1961 Totals

NEW CARS

Make	January 1961	December 1960	January 1960
Chevrolet.....	108,287	145,107	102,856
Ford.....	92,624	119,523	102,854
Pontiac.....	27,494	36,205	24,663
Rambler.....	25,344	31,883	26,841
Oldsmobile.....	24,361	34,446	23,781
Plymouth.....	22,199	30,272	29,946
Buick.....	20,985	27,526	19,621
Dodge.....	16,179	22,295	20,698
Comet.....	11,895	15,537	.....
Cadillac.....	11,794	14,296	10,988
Mercury.....	9,220	13,455	11,821
Chrysler.....	8,671	7,799	5,478
Studebaker.....	6,444	7,333	7,934
Lincoln.....	2,797	2,783	2,336
Imperial.....	1,123	1,812	1,456
Misc. Domestic.....	973	1,872	3,237
Foreign.....	25,594	32,334	40,420
Total—All Makes.....	413,863	544,278	430,116

NEW TRUCKS

Make	January 1961	December 1960	January 1960
Chevrolet.....	21,519	25,802	17,805
Ford.....	20,123	22,093	18,750
International.....	6,074	7,503	7,408
G. M. C.....	5,172	5,975	4,000
Dodge.....	2,630	3,820	2,660
Willys Truck.....	1,582	2,102	1,295
White.....	871	878	1,232
Willys Jeep.....	780	1,330	570
Mack.....	606	729	848
Studebaker.....	330	522	127
Diamond T.....	178	106	205
Brockway.....	57	97	88
Misc. Domestic.....	448	354	589
Foreign.....	1,767	2,239	2,687
Total—All Makes.....	62,307	73,250	58,234

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CAN WORK FOR YOU

For Shear Reliability— Design with Silicone Fluids

Some of the most astonishing things that hydraulic systems are doing today are being done by and because of silicone fluids. In automotive applications, for one, they're the lifeblood of certain long-lasting hydraulic transmissions, power steering, speed-and-temperature-regulated fans. In aviation and other fields, you'll find them in sensitive gyroscopes, damping devices, liquid springs, valve lifters.

MANY USEFUL PROPERTIES

Of course, designing such systems requires knowledge of silicone fluid behavior. Knowledge of viscosity-temperature properties, oxidative and thermal stability, lubricity, thermal expansion, effect on rubber seals of all kinds, compressibility, and apparent viscosity vs. shear rate.

This last is particularly important. And the well-defined shear-viscosity curve of UNION CARBIDE Silicone Fluids, combined with their unique temperature stability (remember that shearing raises fluid temperature), makes them among the most dependable of hydraulic fluids.

You may have heard or discovered for yourself that silicone fluids make elastomeric seals shrink, and may even have dismissed them from your consideration, much as you would like to take advantage of their other properties. Then here is news:

EFFECT ON RUBBER SEALS

UNION CARBIDE has conducted extensive studies of the effect of silicones on various elastomers, and has shown how this problem can be easily met by the use of proper additives in the fluids. In the accompanying table you can see, for example, how "Plexol" 201 additive (Rohm & Haas) in silicones affects the per cent volume change of Neoprene W rubber. Similar data covers per cent weight change, compression set, hardness, etc. Moreover, these data are available on many other natural and synthetic rubber compounds.

How can you get them? They're available now, along with much other important information including more detailed shear-viscosity curves. Just mail the coupon for our latest "Design File" on

UNION CARBIDE Silicone Fluids for Mechanical Applications. It provides in one handy package just about everything you need to know about silicone fluids for your projects.

Effect of Silicone Oil
on Neoprene W Rubber

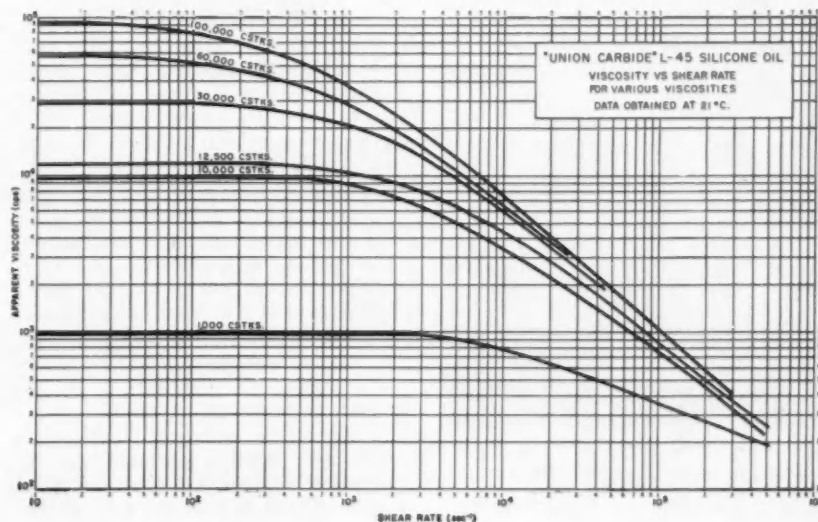
Immersion Fluid	% Volume Change	
	7 days 70°C.	4 days 100°C.
10* L-45	-0.51	-0.15
100* L-45	-0.47	-0.55
1000* L-45	-0.58	-0.69
1000* L-45 + 2.5% "Plexol" 201	4.47	3.75
1000* L-45 + 7.5% "Plexol" 201	17.02	18.60
L-527	8.34	10.66
Water	9.73	15.75

*centistokes

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Union Carbide Corporation
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In Canada: Union Carbide Canada Ltd.,
Bakelite Division, Toronto 12.

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of Union Carbide Silicone Fluids for
Mechanical Applications.

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TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

NEW

PRODUCTION and PLANT

EQUIPMENT

By C. J. Kelly
ASSISTANT EDITOR

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

Industrial Arc Welder

A NEW series of heavy duty industrial arc welders have been introduced for AC manual and automatic production welding operations. Designated the MCM-AC Bumblebee S series, the units come in 300 and 500 ampere sizes and have a 60 pct duty cycle rating.

These welders employ a transformer with a movable coil design that provides a stepless control of welding current and maximum arc response. Other advantages are 80 V open cur-

rent; easily changed voltage connections; and dual 230/460 voltage.

Optional features available with the line include a primary switch, voltage reducer and primary contactor with 115 V, push-buttonset control transformer. *Air Reduction Sales Co., A Div. of The Air Reduction Co., Inc.*

Circle 47 on Inquiry Card for more data

Heavy Duty Transmission

NEW transmission, with electromagnetic clutches, provides speed changes and reversing under power

without disturbing the power source. The capacity of the clutches is 3060 lb ft (running). The transmission has been designated model 18700 EC and is available in 2, 3 or 4 speed changes with a maximum reduction of 10 to 1.

Manual or automatic controlling of speed changes are accomplished with

Vertical Hydro-Tel Milling Machine Announced

A NEW 28 in. vertical Hydro-Tel milling machine, having the versatility and adaptability for general purpose manually controlled milling, die sinking, automatic profile milling and multiple spindle production milling, has been announced.

The machine has a new cross slide and vertical head, with horsepower ratings 50 to 100 pct greater than previous models. All hand and power feeds are hydraulically actuated to

provide effortless manual traverse of slides and smooth, infinitely variable feeds. Table and cross slide levers have five positions for engaging feed and rapid traverse in either direction. Table, cross slide and vertical head feed rates are independent of each other, and can be engaged separately or together. Slide ways and all critical bearings are automatically lubricated. *Milling Machine Div., Cincinnati Milling Machine Co.*

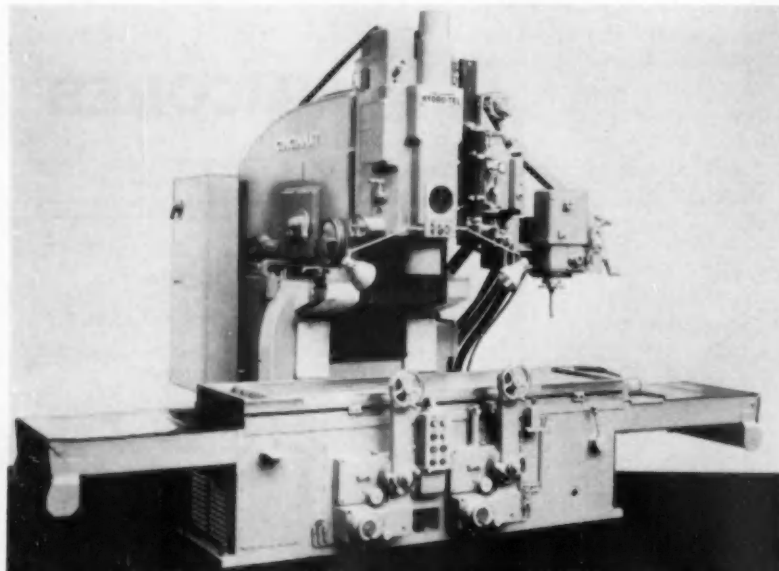


Table and cross slide feeds are infinitely variable from 1 to 25 ipm or $\frac{1}{2}$ to $12\frac{1}{2}$ ipm; vertical head feeds range from 1 to 15 ipm. There are 16 spindle speeds, six optional ranges for the 10 and 15 hp drives, and four for the 20 hp drive.

Circle 49 on Inquiry Card for more data



electric switches, tape, cam or other remote control. The overall dimensions are 34 in. left to right, (end of shafts); 22 in. front to back and $21\frac{1}{2}$ in. high.

The transmission can be supplied for horizontal or vertical mounting. *Western Mfg. Co.*

Circle 48 on Inquiry Card for more data

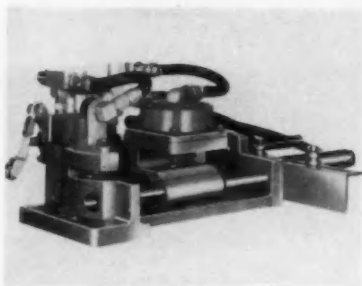
Air Feed Device

A NEW air feed device has been developed for feeding light coiled material to punch presses at speeds up to 250 strokes per minute, with an accuracy up to 0.002 in. The unit will handle materials up to 4 in. wide and thicknesses to 0.060 in. The stroke length is adjustable up to 4 in., and no adjustments are necessary for stock thickness.

The gripper head of the air feed, which carries the stock forward on its feed stroke, travels between hardened metal-to-metal stops. The stock is cushioned for the last $\frac{1}{2}$ in. of travel by a built-in air check.

The timing sequence of the unit with the press is accomplished by means of a roller cam type air valve which is mounted on the side of the

air feed. As the ram of the press goes up, a simple actuating plate mounted to the ram rides off the roller cam valve. This cycles the



feed and causes it to index the stock forward into the punch press. *Sea-Matic Press Equipment*, a Div. of *Special Engineering Service, Inc.*

Circle 50 on Inquiry Card for more data

Dual Valve Assembly

This new dual valve assembly offers electrically interlocked protection for air-actuated clutches. It is designed to be used as an integral part of a clutch-control circuit.

The assembly is designed so that if one valve remains open when de-energized the other valve will close and stop the machine. Before another stroke or cycle can be started, the defective valve must be repaired or replaced, a feature designed to protect machine operators and tools.

The dual valve assembly meets JIC specifications and includes two 3-way valves connected in series, two limit switches actuated by the poppet extensions of the valves, and a wiring enclosure housing the terminal strip. The entire assembly is prewired in oiltight conduit and mounted on a heavy-gage steel panel.

The dual valve assemblies are available with $\frac{3}{8}$ and $\frac{1}{2}$ -in. valves and in 115, 230 or 460-v, 60-cycle AC. *Minneapolis-Honeywell Regulator Co.*

Circle 53 on Inquiry Card for more data

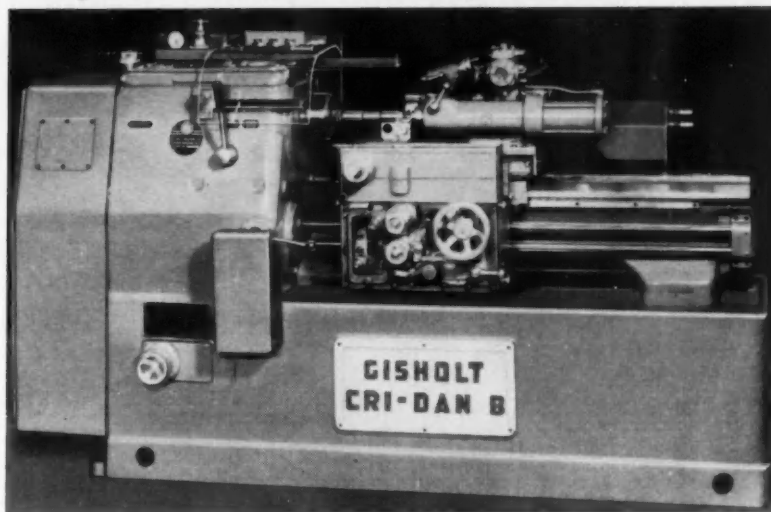
Cup Packings



Cup packings made of Rulon, a fluoro-carbon compounded with reinforcing agents to make it chemically inert and wear resistant, offers a low coefficient of friction under completely non-lubricated conditions.

Circle 54 on Inquiry Card for more data

Improved Automatic Threading Lathe With Tracer



This machine will be demonstrated by Gisholt at the ASTME exposition (Booth 2537). Called the Cri-Dan B automatic threading lathe, it will be used to show how single point carbide tools can produce highly accurate, quality threads and fine finishes in all materials at high production rates. On the spot set-ups will be made by request. The workpiece will be a $10\frac{1}{4}$ in. long, $1\frac{1}{2}$ in. dia Diesel engine stud made from LaSalle Stressproof bars with copper. *Gisholt Machine Co.*

Circle 51 on Inquiry Card for more data

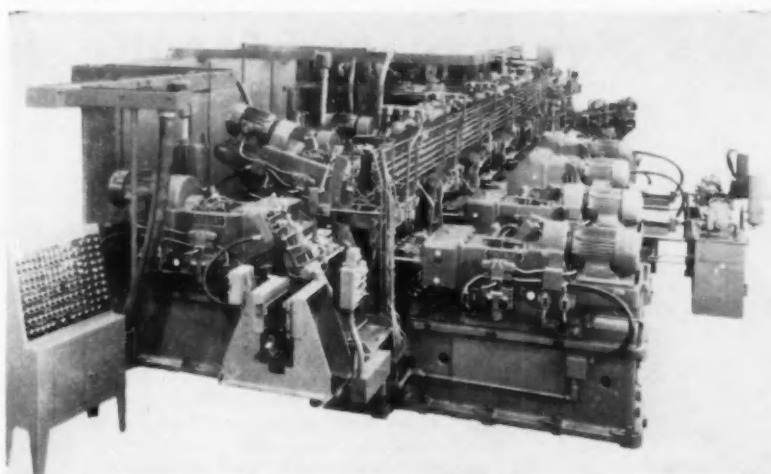
17-Station 64-Spindle Transfer Machine

A 17-STATION, 64-spindle transfer machine has been developed to drill, ream, chamfer, spotface, counterbore, core drill, and tap holes in automotive cylinder heads. The machine, which is 46 ft long by 17 ft wide, accepts heads from the last station of a previous machine, and deposits them at a forwarding index station for further processing. Production rate is 103 heads per hour at 80 pct efficiency. Three stations are furnished with only one way-unit each (all other stations have two way-units each), leaving the opposite side

vacant for addition of future units if desired.

All units of this machine employ hydraulic feed, except for one 2-spindle tapping machine, which has a lead screw and reversing motor. All heads slide on double cylindrical ways—a Foote-Burt exclusive. Chips cannot collect on these ways to jam the heads or mar the slides. Ten of the 12 units are equipped with pick-off speed-change gears to permit machining either aluminum or cast-iron cylinder heads. *The Foote-Burt Co.*

Circle 52 on Inquiry Card for more data



Control of new transfer unit is through a master panel separate from the machine. There is an auxiliary control to start or stop the entire line at station 1.

working with

Du Pont DELRIN®
acetal resins

*one of Du Pont's versatile
engineering materials*



**Ball seats
of
DELRIN®**

give "greased-for-life" joints

For many 1961 cars, ball seats in a lubricated-for-life steering linkage are molded of Du Pont DELRIN acetal resin. This new steering system offers smoothness of operation and ease of handling not achieved with other steering linkages. A careful consideration of the functional requirements of ball seats in this application led to the choice of DELRIN.

First, the material chosen needed to have a low coefficient of friction against steel, and the static and dynamic coefficients of friction had to be about the same to give a smooth, even feel to steering. DELRIN has the required frictional properties.

Second, the material had to be tough over a wide range of temperatures (-40° to 250°F.). DELRIN is.

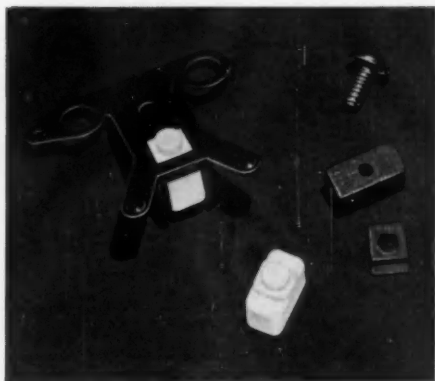
Third, the material had to be unaffected by any solvent action of the lubricant up to 250° F. DELRIN has the chemical resistance needed.

Fourth, the material had to be dimensionally stable under the load and in the environmental conditions encountered. DELRIN is.

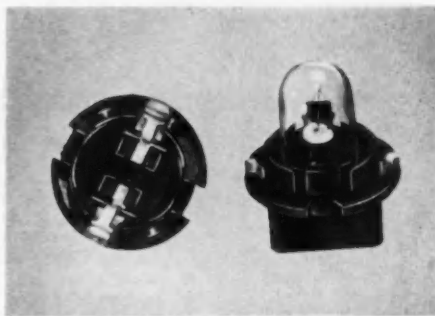
Severe laboratory and road tests proved that DELRIN acetal resin had the high strength and resilience necessary to maintain a permanent tight fit.

This is one example of the ways in which the remarkable properties of DELRIN are being used today to improve the performance and to lower the costs of automotive components.

There are more examples on facing page.



Coil assembly for automotive fuel pump is made of a single part of DELRIN, replacing a screw and two machined phenolic-laminate parts. Assembly is a simple, fast cold-heading operation which eliminates a tapping operation. DELRIN provides the superior heat resistance, toughness and dimensional stability required. (Molded by Arjay Mfg. Co., Vassar, Michigan, for Walbro Corp., Cass City, Michigan.)



Lamp socket molded of DELRIN is designed for use in dash lighting and other assemblies using printed circuits. It accommodates new socket-less bulbs. DELRIN acetal resin provides the required high-temperature resistance, creep resistance, electrical properties and resilience . . . and does so at lower cost than other materials. (Lamp sockets are manufactured by Wade Electric Products Co., Sturgis, Michigan.)

One-piece moldings of DELRIN® simplify design and lower assembly-line costs

One important variable in the cost equation is, of course, the cost of assembly and installation. In this area, DELRIN often makes possible design simplifications by the use of one-piece injection moldings instead of multi-part assemblies. The three products shown above illustrate the point.

For additional information on the properties and applications of DELRIN in the automotive field, mail the coupon below. The same coupon will bring you relevant information on any of Du Pont's versatile engineering materials.



Disc retainer guide of DELRIN replaces conventional stem and stem guide of bronze in foot and line check valves. Guide of DELRIN gives improved flow characteristics, reduced pressure drop, longer life . . . is designed for use up to 180°F. in water, oil or gasoline pumping installations. (Molded by Holman Manufacturing Co., for White Flomatic Division of Flomatic Corporation, both of Hoosick Falls, N. Y.)

POLYCHEMICALS DEPARTMENT



BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

DELRIN® acetal resins

one of Du Pont's versatile engineering materials

Alathon® • **Lucite®** • **Zytel®**
polyethylene resins acrylic resins nylon resins

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Please send me information on the following:

☐ DELRIN® ☐ ALATHON® ☐ LUCITE® ☐ ZYTEL®

Name _____

Company _____ Position _____

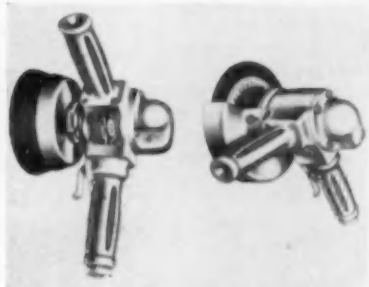
Street _____

City _____ Zone _____ State _____

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

Air Grinders

Two new series of vertical air grinders have been introduced for various types of grinding. The series have been designated the 505 and the 532. The 505 is a regular duty 6000 rpm 9 in. depressed center wheel tool. The 532 is a heavy duty 6000 rpm 6 in. flared cup wheel.



Lever throttles which give momentary action and quick shut-off are standard. A throttle safety lock provides positive shut off for safety when changing wheels. Magnesium housings and design of all parts have produced a light but rugged tool. A full-flow throttle, and lack of restrictions in the air passage combine to assure maximum power output. *Albertson and Co., Inc.*

Circle 55 on Inquiry Card for more data

2-Spindle High Speed Unit For Deburring

This machine, at a 15 second time cycle, will produce 240 pieces per hour and will handle parts up to 6 in. in diameter. The operation is completely automatic except for loading and unloading. The Mecha Finish Corp.

Circle 56 on Inquiry Card for more data



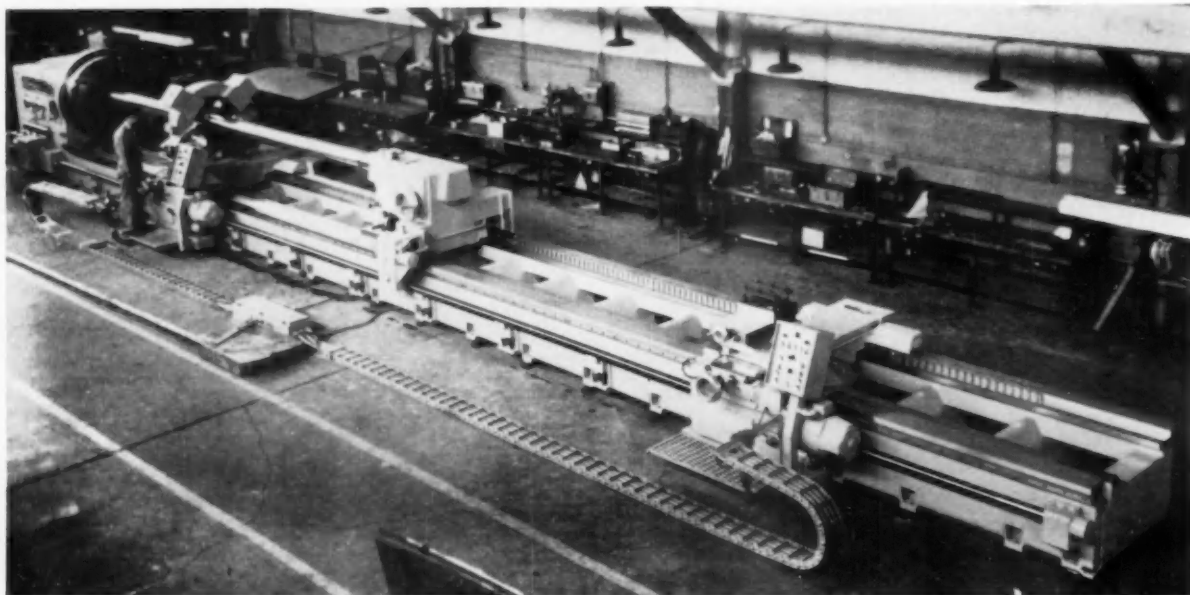
ANNOUNCEMENT has been made of a new 75 hp machine that employs the Mechamatic process for fixtured deburring and finishing a multiplicity of parts or a single component. Known as the MM-2, this high speed, 2 spindle unit is designed for low production of many parts or high production of a single workpiece.

The two spindles operate independently of each other allowing the op-

erator to service one while the other is in process. Spindle station interlocks are available for the purpose of pacing the machine operator.

The parts are mounted on spindle fixtures, air operated, which are submerged while rotating, in a fluid abrasive mass which travels at approximately 2000 sfm. This simulates a form fitting grinding wheel, regardless of the shape of the part.

Giant Lathe Believed by Manufacturer to be one of World's Largest



Known as the Blue Chip model 6040, this large machine embodies the progressive concept of design and construction that Clearing uses in its welded-steel lathe line. It can turn a part 40 in. in dia. and turn a bar 50 ft long between centers. Built entirely of welded steel, the lathe has been put together in two sections. Capacities of the lathe are: 60 in. swing over bed ways and carriage ways; 40 in. swing over cross slide; 50 ft 9 in. between centers; 66 ft 6 in. overall length. The lathe will be operated in the U. S. Steel plant in Homestead, Pa., and was manufactured by USI Clearing Div. of U. S. Industries, Inc.

Circle 57 on Inquiry Card for more data

NEW

PRODUCTS

AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

By C. J. Kelly
ASSISTANT EDITOR

Heavy Duty Truck Grill

A giant earth mover is being equipped with a protective radiator grill fabricated of $\frac{3}{8}$ in. diameter steel wire. The heavy duty resistance welded assembly measures 4 ft 6 in. by 2 ft 6 in. Two are used for each unit.

The wire grill was chosen for its ability to withstand the hard knocks of construction work, and because its open, air-free construction provides improved engine cooling. The grill was custom designed and manufactured by E. H. Titchener & Co. for the equipment manufacturer.

Circle 40 on Inquiry Card for more data

Vacuum Power Brake

A new vacuum power brake unit has been designed for application on small and medium size trailers that are equipped with brake drums and hydraulic wheel cylinders. The new unit, named the Uni-Brake, combines several components heretofore requiring separate combinations.

Unusually compact in size, completely self-contained with built-in reservoir, $1\frac{1}{4}$ " hydraulic master cylinder, check valve and brake release cock, it is developed for vacuum op-



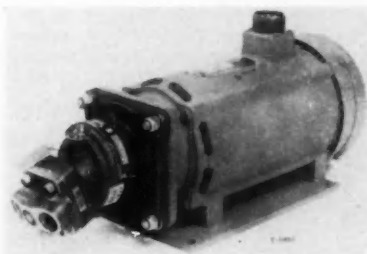
eration from any gasoline powered towing car or truck. It is easily hooked up to power brakes on towing car for foot-pedal-synchronized braking so important for safe stopping with various types of trailers up to three tons capacity. It requires no external levers or adjustments.

Two models of Velvac "Uni-Brakes" are at present available. Model 49D-4x8, is for commercial use with $\frac{1}{2}$ " hose, and model 49D-4x6 is for $\frac{3}{8}$ " hose. Each provides automatic brake application on disconnect, an added safety factor. They are rated 1.44 cubic inches of brake fluid, 800 psi at 20" vacuum. Mostly standard parts are used in this unit so that they can readily be replaced in the field. Velvac, Inc.

Circle 41 on Inquiry Card for more data

Motorpump for Aircraft

The hydraulic power required to open and close the giant swing tail of a new cargo carrying aircraft is



supplied by a recently developed AC motorpump.

The hydraulic pump, driven by an AC electric motor, is an axial piston unit with a fixed displacement of 0.134 cu in. per revolution. The motorpump package provides a minimum delivery of 4 gpm at 21 psia inlet pressure, 3000 psig outlet pressure, and 115/200 volts. Its dry weight is approximately 29 lb. Overall size is approximately 16 by 5.5 in. A DC version of this package also is available. Aero Hydraulic Div., Vickers Inc., a Div. of Sperry Rand Corp.

Circle 42 on Inquiry Card for more data

Heavy Duty Brake Drum

Claimed to be the coolest operating drum ever designed, a new brake drum has been designed for trucks operat-

ing under extremely adverse braking conditions. The new component has more iron in the inner surface than



other units produced by the manufacturer and incorporates a special air scoop. This scoop consists of a steel flange that is welded to the drum shell. The idea of the flange is to set it in the air stream to pull in sufficient quantities of air to keep the temperature of the drum well below the critical range. This new part is available in the $16\frac{1}{2}$ in. size. Motor Wheel Corp.

Circle 43 on Inquiry Card for more data

Natural Gas Carburetor

Pre-set to the engine's true power curve this new, natural gas carburetor ($\frac{1}{2}$, $1\frac{1}{4}$, $1\frac{1}{2}$ and $1\frac{3}{4}$ in.) is designed specifically for engines operating on natural gas, manufactured gas or LP-gas as a standby fuel. It operates directly from an ounce regulator on natural gas with no final stage of regulation or from an atmospheric regulator on LP-gas. Available for either updraft or downdraft installations, it features an automatic choke for instant starting. According to the manufacturer, this is the first "low cost" carburetion to efficiently handle natural gas—a claim made on the basis that no secondary regulators or other devices are required and elaborate "plumbing" systems are eliminated. Imperial Machine Products Co.

Circle 44 on Inquiry Card for more data

Mechanization in Push-Rod Cover Fabrication

(Continued from page 46)

Stamped rings are fed into two track magazines, Fig. 5, from Syntron hoppers that are loaded manually. Magazine loading is automatic. Each ring rolls down the magazine to a stop where it is in line with a punch at each end in the eighth work station. When a tube is indexed into line with the two punches and they are advanced, each forces a ring over an expanded tube end and then retracts leaving the outer flange of each ring flush with the end of the tube.

Upon advance from this station, the fixture moves around the chain sprocket. On its way, the tube assembly is lifted out of the fixture and rolls down a chute from which each assembly is picked up by hand and is set in a brazing fixture (background in Fig. 6) holding 20 tubes. When each brazing fixture is filled, the operator lays the fixture on the wire mesh belt, right in Fig. 6, that carries the fixture and its load through a Westing-

house electric brazing furnace.

Advance through this furnace is automatic and results in heating to 2050 F, the proper brazing temperature. Capillary action causes the heated brazing mixture to flow around the ring bores where the rings are sweated onto the mating ends of the tube. Thereupon, the assemblies advance through a cooling zone and issue adjacent to the final test station, Fig. 7.

The brazed tube assemblies are unloaded from racks and are set into a dunking fixture holding 14 pieces. When these are in place, the operator presses a button that air clamps the whole group, sealing the ends against rubber backings, and admitting air at 15 psi inside each tube. This is done, of course, with the fixture well above the water level in the dunking tank below.

When another pair of buttons is pressed, the fixture is rocked down to a position where all assemblies

are submerged in water that is heated so as to expand the tubes and also to promote rapid subsequent drying. Good illumination of the tank contents makes it easy for the operator to spot any leakers by air bubbles that escape. Finally, the fixture is elevated and unlocked and the operator removes the completed assemblies, discarding any leakers and placing the others in a tote box for delivery to plating.

It is noteworthy that the entire procedure described is done at high speed and is automatic save for loading parts into brazing fixtures, taking them from these fixtures and putting them through the final test fixture.

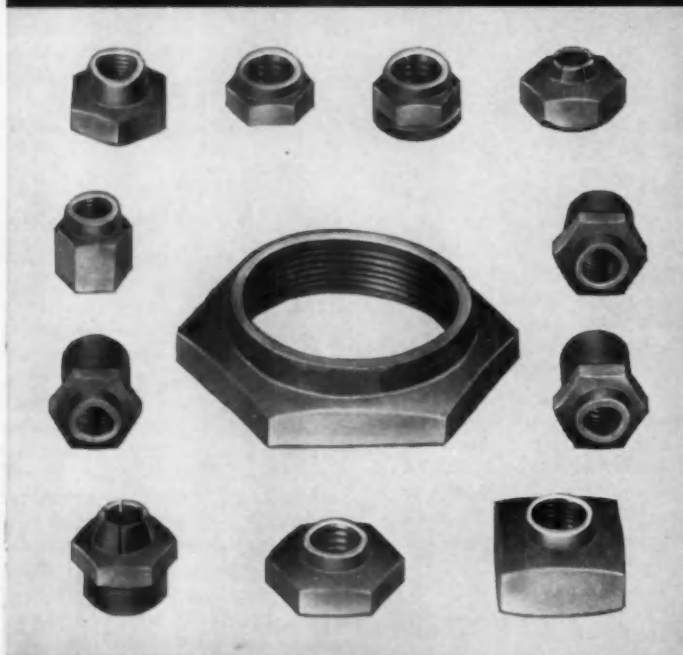
The process is simple and relatively inexpensive and the equipment is compact, requiring a minimum of floor space. ■

Mobile Homes Officers

F. A. McCallum, of St. Louis, Mich., has been elected president of the Mobile Homes Manufacturers Association.

SPECIAL LOCKNUTS . . .

that solved fastening problems



As the largest specialized nut manufacturer in the world we are constantly developing new methods and products for this phase of assembly in industry . . . in the field of locknuts we have made spectacular progress. Besides standardized hexagon "Conelok," "Huglock" and "Marsden," sizes #10-3" of ferrous and non-ferrous materials, we provide many special application nuts, upon a basis of these designs . . . a few of which are here shown . . . Our sales and engineering departments are available to help you solve your fastening problems . . . Send for 12-page condensus catalog, it includes complete specifications of our entire product, as well as engineering data. We also have an one hundred and forty four page catalog where more comprehensive information is required.

Manufacturers of Standard and Special ferrous and non-ferrous Hexagon, Square and "12 Pointer" nuts . . . "Conelok," "Huglock" and "Marsden" locknuts.



NATIONAL MACHINE PRODUCTS COMPANY

an **sps** company 44250 UTICA ROAD UTICA, MICHIGAN



The Defense Dept. now admits its industry bidding policies need a going-over. After years of battling over the value of negotiated contracts and competitive bids, the Pentagon has agreed to give "particular attention" to competitive bidding.

Officials of the General Services Administration say the agency's new "buy faster" policy will be a great boon to the metalworking industry. GSA is now buying supplies for the government on an accelerated basis. Sources at the buying agency say it will mean \$91.5 million buying from industry between now and September.

New industrial mobilization stockpiling plans—including storing up space age metals, finished metal products and machine tool components—appear to be in the works. The plans, formulated some time ago, are expected to be part of "far reaching recommendations" for changes in U. S. industrial mobilization being made by Frank B. Ellis, new civil and defense mobilization director. He calls the present program "completely inadequate."

In the face of Congressional calls to give the government rights to all patents developed by industry under Federal research and development contracts, comes this conclusion: "There seems to be no urgent reason to alter the patent policies now in operation." The conclusion is from a study by the Patent, Trademark and Copyright Foundation of George Washington University.

The National Labor Relations Board means to use the teeth in the Landrum-Griffith labor law to bar illegal "hot cargo" contracts between unions and employers. Under a so-called "hot cargo" contract, employers agree not to handle products made in nonunion plants. Recently, workers struck to force agreement to the illegal provision. The board ruled such strikes are violations of the law.

The U. S. has begun a study of rocket motors for space vehicles that will revolutionize research on vehicle thrust and propellants. National Aeronautics and Space Administration has awarded study contracts to develop rockets with thrusts of six million to 12 million lb. The best thing the U. S. now plans is the Saturn rocket, which will have a thrust of 1.5 million lb. Study contracts for the new rockets have been awarded to Convair, Lockheed and North American.

U. S. plans to explore the moon are "well advanced," top space officials say. Test flights of a vehicle to survive a crash landing on the moon will be held this year. In the next two or three years, government space experts reveal, the U. S. will shoot nearly a dozen moon exploration spacecraft and five or more probes of Venus and Mars.

Hobbs **B** DUAL CIRCUIT PRESSURE SWITCHES



Add a NEW
B DIMENSION
to Pressure Activation!

DOUBLE DUTY! Disconnects one electrical circuit while placing the other in operation. Industry-approved for a wide range of applications in dual circuit activation of various types of instruments, warning signals, safety devices, fuel pumps—in many other ways for making and breaking circuits. Ideal for locking out a starting motor while the engine is running. Can be used with oil or air... or with standpipe, almost any liquid or gas.

- Non-ferrous pressure chamber
- Phosphor-bronze diaphragm
- Alloy contacts
- Preset at factory

Available in pound setting specifications in both circuits within ranges of 3-6, 7-14 and 15-60 psi. Compact—only 1-11/16" diameter. Pressure assembled and pretested at 150 psi. Designed for use on direct current.

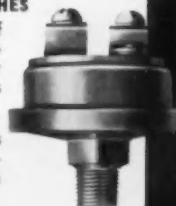
A COMPLETE LINE OF PRESSURE SWITCHES

Also available—a wide selection of single circuit pressure switches. Single terminal; double terminal; normally open; normally closed. Pressure ranges of 3-6, 7-14 and 15-60 psi.

Built by the manufacturers of Hobbs Running Time Meters and Shock-Mounted Head Lights. Distributors in principal cities...

WRITE FOR CATALOG PS605.

John W. Hobbs Corporation
A DIVISION OF STEWART-WARNER CORPORATION
2081 YALE BLVD., SPRINGFIELD, ILLINOIS

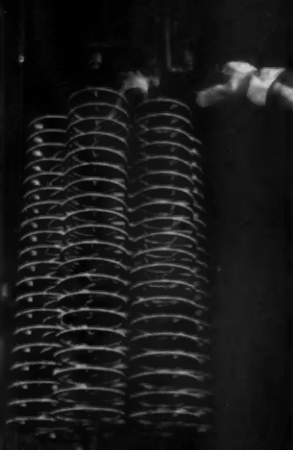


FROM AMERICA'S LEADING PRODUCER OF PISTON RINGS...

PERFECT CIRCLE PRECISION CASTINGS

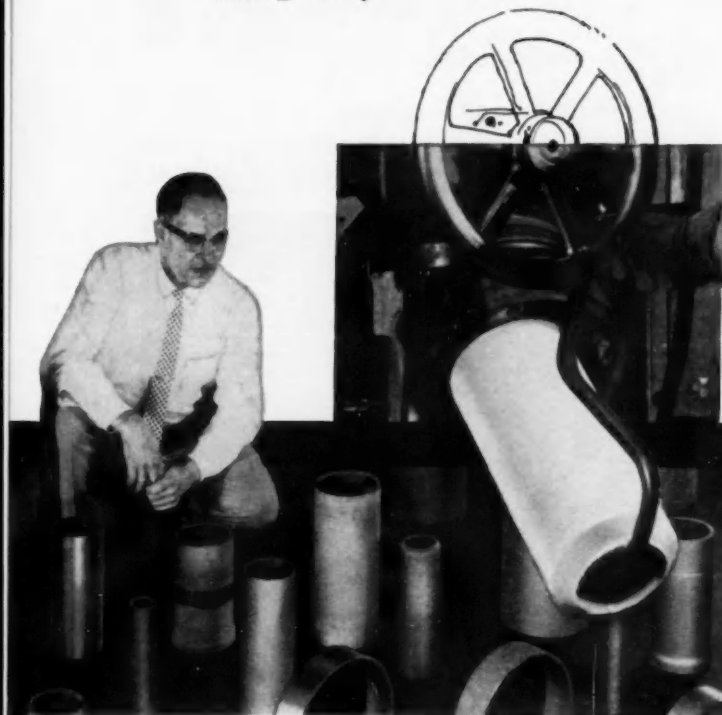
STACK-MOLD CASTING

Molds of carefully-controlled green sand are made from the pattern plate, and stacked for pouring. In the example shown at right after shake-out, the castings are 6-up in a stack 20 molds deep. Typical castings produced by this Perfect Circle process include piston rings, thrust plates, valve lifter facings and piston groove inserts.



Mass-produced to the highest quality standards

Every year, Perfect Circle produces millions of piston rings—all made to the exacting specifications that have set precision standards for the industry. Now, as the result of extensive expansion, the modern facilities and metallurgical skills of Perfect Circle are available for volume production of superior gray-iron castings to your specifications. And, through its advanced production techniques, Perfect Circle can bring you the finest metallurgical and dimensional precision at important cost advantages. Get complete information on Perfect Circle castings today!



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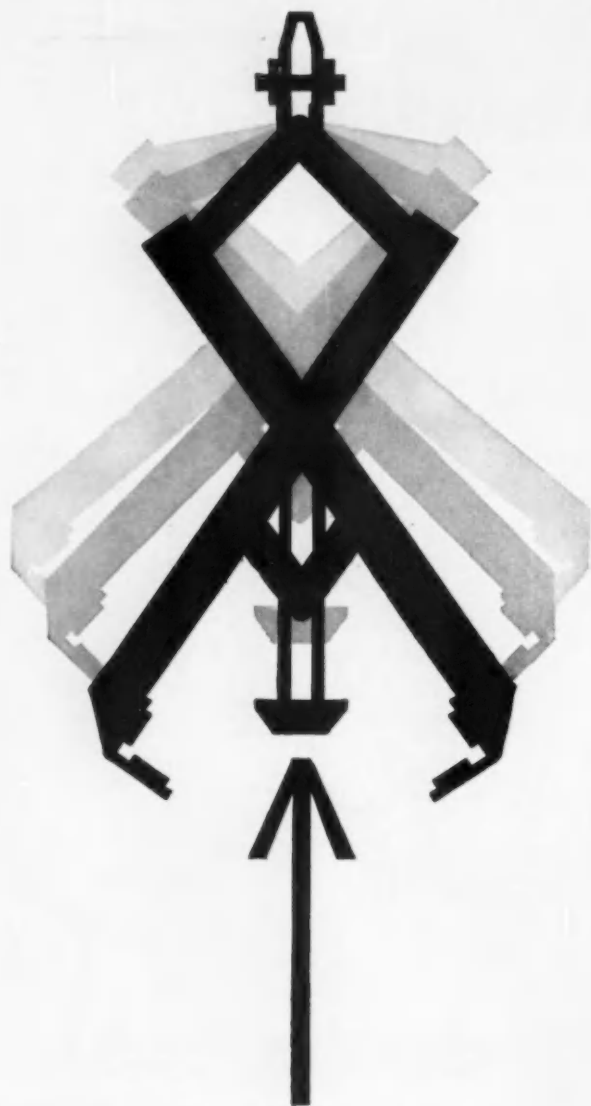
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Manufacturers' News

Inco Profits Decline

Earnings for 1960 fell below those of 1959 International Nickel Co., Ltd., has reported. Deliveries this year should be about the same as last year, shareholders were told. Earnings last year were \$80,701,000, or \$2.76 a share, down from \$85,157,000, or \$2.91 a share, in 1959. Capital expenditures last year rose to \$75.9 million from \$66.9 million in 1959.

Acquisition Explored

Firestone Tire & Rubber Co. has started an "initial investigation" into possible acquisition of the Dayton Tire Co., a division of the Dayco Corp. A Firestone official said "Dayton approached us on the purchase of the Dayton tire factory. Dayton spokesmen said highly competitive factors resulted in a deficit for the fiscal year ended last Oct. 31.

Urethane Seat Cushions

Beech Aircraft Corp. is using urethane foam for seat cushions and back rests in aircraft



Nopco Lockfoam Seats in Beech Aircraft

chairs. "Lockfoam" and foamed-in-place system used at Beech were developed by Nopco Chemical Co.

The switch to urethane was made on the basis of superior resistance to mechanical abuse, oils, greases, fire, fungus and mildew. Foam cushions can be repeatedly cleaned and re-upholstered.

Nash-Universal Merger

J. M. Nash Co. has acquired Universal Motor Co., Oshkosh, Wis., in an exchange of stock transaction. It was the seventh firm acquired by Nash in four years. Universal is one of the

oldest and largest manufacturers of marine engines. They also make complete lines of electric power and light plants. Ralph G. Klieforth will continue as Universal's president and general manager.

S-P Purchases Concern

Studebaker-Packard Corp. has acquired Chemical Compounds, Inc., of St. Joseph, Mo. S-P purchased the chemical concern's stock for cash and will make additional payments from future earnings. Chemical Compounds processes and distributes additives for motor oil and fuel. Chemical Compounds is the sixth firm acquired by S-P.

Perfect Circle Report

Perfect Circle Corp. net sales of \$37.1 million in 1960 were within seven per cent of the all-time high in 1959. Net earnings of \$2.4 million were second to the previous year's record earnings. Per share earnings in 1960 were \$2.13 while in 1959 they were \$3.37. W. B. Prosser, president, said replacement sales were higher than in record 1959 and that export sales were the highest in history.

Electronics Control Quenching Operation

DISTORTION-FREE ring gears and other gear parts are being produced at the Dagenham, England, plant of Ford Motor Co. through use of automation techniques in controlling quenching presses during heat treating operations.

Use of the automatic control system—believed to be the first of its type—also has eliminated scrap, according to Minneapolis-Honeywell Regulator Co., whose British subsidiary installed the instrumentation.

Each of 10 quench presses at the Dagenham plant is equipped with a Radiamatic infrared detector which, in turn, is connected to its own panel-mounted ElectroniK indicator-controller.

The quenching operation, in three stages, becomes fully automatic when the work piece, heated to approximately 1610 F, is placed in the press.

Radiant energy from the heated metal part is focused by a lens onto a thermopile, creating a millivolt signal to actuate the controller. When the indicator reading, which falls with cooling of the work piece, reaches a set point of 1510 F the controller's mercury contact closes, initiating the quenching cycle. The contact remains open if a part that is below quenching temperature is placed in the press.

Closing of the mercury contact actuates a motor-driven mechanism which clamps and moves the work piece horizontally, and opens the first of three oil inlet valves. Timing of the oil bath is carried out within the machine. A typical three-stage quench might have timings of 15, 15 and 30 seconds. ■



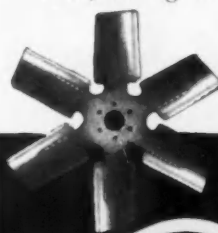
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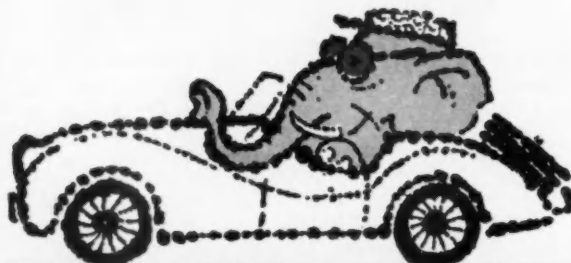
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By C. J. Kelly
ASSISTANT EDITOR

Lubrication 1

All questions about PoxyLube lubricants are covered in a catalog folder. It tells what type to use for a specific application, properties of the various types and how the lubricants work. Illustrations and charts are included. *Poly Chem, Inc.*

Analog Computer 2

A 20-page brochure describes the model 231R, 100 amplifier, general purpose analog computer. It describes in detail the basic system, the "building block" design which allows easy expansion and the many automatic features designed for this computer. *Electronic Associates, Inc.*

Drilling Machines 3

New 6- and 8-spindle turret drilling machines are described in this bulletin. Details include pre-selective speeds and feeds, automatic or tape controls, variety of table sizes, and a model with the turret mounted on a bridge or rail. The bulletin also includes full specifications and dimensional drawings. *The Avey Div., Match & Merryweather Machinery Co.*

Release Agents 4

"Moldlubric LCS" and "Moldlubric 3326" are two data sheets describing new die release agents. Sheets describe features giving better castings; performance data. "LCS" is for large, intricate castings. "3326" is for aluminum die and permanent mold casting. *E. F. Houghton & Co.*

Speed Drive Line 5

Six-page Bulletin 2900 outlines an extensive line of adjustable speed drives for applications in the $\frac{1}{2}$ to 2500 hp drive range. The bulletin describes four types of complete packaged adjustable speed drives and gives details on available ratings, speed ranges, type enclosures, associated controls and many standard and special modifications. *The Louis Allis Co.*

Belt Finishing 6

Called "Wide Belt Finishing," a new folder recites case study results where use of wide belts and wide belt machines, for both wood and metal working, cuts costs and expedites production while maintaining quality. *The Carborundum Co.*

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Bar Feed Unit 7

Means for automatically feeding round, square or hex bar stock or tubing to lathes or screw machines by low air pressure are displayed in catalog sheet 31260. This sheet describes the Power Grip bar feed, which feeds stock to be machined for any desired length. Features listed include ease of installation and operation, elimination of hand feeding, speed and accuracy, adaptability and safety. Specifications and capacities are given. *Power Grip, Inc.*

Alternator System 8

A two-page data sheet describing the engineering features of a new 6000 series 40-ampere alternator system for cars and trucks has been published. Fully illustrated, the free literature provides wiring system diagrams for positive and negative automotive ground systems, illustrates and describes significant alternator dimensions, and lists product operating and engineering data. *The Leece-Neville Co.*

Fastener Line-Up 9

An eight-page condensed bulletin describes a complete line of standard precision industrial fasteners including socket screw products, pressure plugs, locknuts, spring pins, dowel pins and steel collars. An information-packed review shows specification information on the company's Unbrako, Flexloc, Sel-Lok and Hallowell lines. The bulletin details basic data on types, sizes, threads and plating, and spells out design features and application information. This gives the literature added dimension, as a useful thumbnail guide to important fastener features. *Standard Pressed Steel Co.*

Materials 10

A comprehensive list of all its Spauldite fire resistant industrial plastics which are self-extinguishing as determined by ASTM D635, includes the descriptions, characteristics and specifications of 15 different Spaulding-made plastics of the phenolic, epoxy, melamine and polyester laminate types. Also included is information on Spaulding's copper-clad fire-resistant materials. *Spaulding Fibre Co.*

Laminates 11

A new complete-line catalog on Textolite industrial laminates—copper-clad, sheets, tubes and rods has been given the designation L-CDL-514. 16-page catalog, lists a total of 39 grades, contains information on rolled and molded tubing, insulation and printed circuit applications. Included are nine new products—two copper-clads, five standard sheets and two new tubes. In addition, revised data on present and improved grades is included as well as properties, tolerances and thickness ranges of all Textolite industrial laminates. *General Electric Co., Laminated Products Dept.*

Special Steels 12

Three grades of Heppenstall special steels are described in Data Sheets 19, 20, and 21. General characteristics and typical applications of each grade, together with instructions for forging, annealing, hardening, tempering, and other information are contained in each data sheet. *Heppenstall Co.*

Pushbutton Stations 13

Bulletin GEA-6544A, eight pages, discusses a line of pushbutton stations for standard and heavy-duty applications. Publication includes photos of standard pushbutton units and stations, diagrams showing dimensions and ordering information. Photo with callouts explains features of typical heavy-duty pushbutton station. Also shown are typical applications of various pushbutton stations. *General Electric Co.*

Ideas Booklet 14

A new 32-page illustrated booklet presents interesting application ideas for single spindle chucking automatics. Featuring an unusually large number of detail line drawings and photographs, the new booklet describes interesting machining jobs on chucking automatics in shops across the nation. Information on workpieces, tooling, machine functions, setup and methods is carefully presented. This data should be of help to all "AC" machine users in getting the most from their equipment, and of interest to anyone contemplating installation of accurate, high production turning machines. *The Warner & Swasey Co.*

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Abrasive Products 15

Catalog of abrasive belts, rolls, sheets and discs, lists standard coated abrasive products used throughout industry. All items listed in this standard catalog are maintained in stock at Carborundum warehouses by electronic order processing and inventory control. A customer "tool," to help cut costs and expedite service through use of standard catalog items. *The Carborundum Co.*

Cost Cutting 16

A new four-page folder is entitled, "How 80 per cent of American Companies Can Save Tooling Costs." The new folder is the result of a recent survey of jig and fixture design and building practices which indicated that in approximately 80 per cent of American companies the jig and fixture components now mass produced and available as standards are still being designed, engineered and made in captive tool rooms as "specials." The folder graphically illustrates and translates into "dollars and cents" for specific items the savings in engineering and design time, paper work and tool room man hours when standard components are designed into a job and ordered from the distributors' stock. *Jergens Tool Specialty Co.*

Carbides 17

Profitable utilization of high rigidity in a material that has three times the stiffness of hardened steel are spot-lighted in a new 16-page pocket-sized booklet. The booklet also notes the combination of other unique and complementary properties of the hard carbide, such as wear resistance up to 100 times that of steel, high resistance to corrosion-abrasion, dimensional stability, and others that contribute to profitable applications in industry. *Kennametal, Inc.*

Gun Welders 18

A new issue of "Tips and Dies," volume 4, number 1, is available in color. The four-page pamphlet describes and illustrates 14 Multi-Gun Welders, modern methods for mass production of fabricated parts. *The Federal Machine & Welder Co.*

Soluble Concentrates 19

Twenty-six different types of Shear-Speed cutting fluids and lubricants are covered in a new 52-page catalog. Data on fluids of the same type are listed on pages of the same color so fluids can be selected by application. Physical and chemical properties, typical uses and descriptions of each are conveniently tabulated. Features and uses of each fluid are discussed, along with application hints and dilution tables for soluble concentrates. *Shear-Speed Chemical Products, Div. Michigan Tool Co.*

Bolts 20

Higher bolting strength for temperature applications up to 1200 degrees Fahrenheit is the subject of a new four-page technical bulletin. Complete mechanical properties are covered, with tests at room temperature, at 1200 degrees, and at room temperature after a 100-hour soak at 1200 degrees. Included are the 23-hour stress-rupture strength and the 50-hour relaxation from 80,000 psi. *Standard Pressed Steel Co.*

Manual Starters 21

Brochure 10-B1 describes a complete line of manual starters for fractional horsepower motors. These new devices are available as single and two-pole units with built-in thermal relays to protect the motor from sustained overload. Incandescent or neon pilot lights to indicate operational status and toggle guards which will accept a padlock are optional equipment. The trip-free melting alloy type thermal relay contacts cannot be closed until the overload has been eliminated and the eutectic alloy solidified. *Furnas Electric Co.*

Stainless Steel 22

Four-page brochure describes new bright annealed stainless steel finish for automotive applications. Process reduces and often eliminates buffing. Continuous roll forming of strip stock makes possible wider variety of complex shapes at substantially lower fabrication cost. Back page describes Sharonart, coated products, forging quality, high tensile, spring and special alloys available. *Sharon Steel Corp.*

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Arc Welding 23

Information concerning tech-
niques for welding stainless steel
is contained in bulletin 7300.2—
entitled "Arc Welding Stainless
Steel." This bulletin gives physi-
cal properties, structure, and weld-
ing characteristics of the different
types of stainless steels. It also has
a chart listing deposit properties
and electrode recommendation
tables for the different types of
stainless steel. *The Lincoln Elec-
tric Co.*

Barrel Plating 24

Modern, multi-use barrel plating
equipment is cataloged in a 16-
page booklet. Major plating barrel
specifications augment 38 photo-
graphs and recommendations for
barrel assemblies, horizontal bar-
rel units, loading stands, storage
and transfer units and final rinse
units. Automatic machines, cen-
trifugal dryers, heating and cool-
ing coils, tank linings and rectifi-
ers are discussed. *The Udyllite
Corp.*

Turret Lathe 25

A new bulletin illustrating and
describing the Rivett 60 Series pre-
cision turret lathe has been pub-
lished. The bulletin highlights six
"Firsts," with particular emphasis
on the new "One Motion Control,"
and an automatic indexing turret
which passes over top of double
tool cross slide. *Rivett Lathe &
Grinder, Inc.*

Heat Treat Review 26

Contains an interesting article
on safety standards for heat treat-
ing equipment, which outlines the
responsibility for the equipment
users, the furnace manufacturers
and the insurance associations.
Other articles cover a discussion
of bell type coil annealing furnaces
which utilize power connection, and
also a case history of commercial
heat treater who could not expand
his plant because of land shortage,
but found a way to double his
production. The full color photo-
graph also serves to illustrate an
inside article which describes the
annealing of deep-drawn ferrous
and non-ferrous metal parts. *Sur-
face Combustion, Div. of Midland-
Ross Corp.*

Film Rental 27

Eighty-eight keys to American
work simplification and industrial
engineering techniques are pro-
vided in the 1961 edition of the
Industrial Management Society
film rental catalog. Produced by
leading American companies and
universities, these films all have
won awards in the annual Methods
Improvement Competition spon-
sored by the Society. The folder
explains the terms covering the
rental of these 16mm films. The
films are approximately 10 to 15
minutes long in running time and
picture "on-the-job" training and
work simplification projects in
both plant and office operations.
Industrial Management Society.

Postcard valid 8 weeks only. After that use own letterhead describing item wanted.
Please send further information on items circled below.

4/1/61

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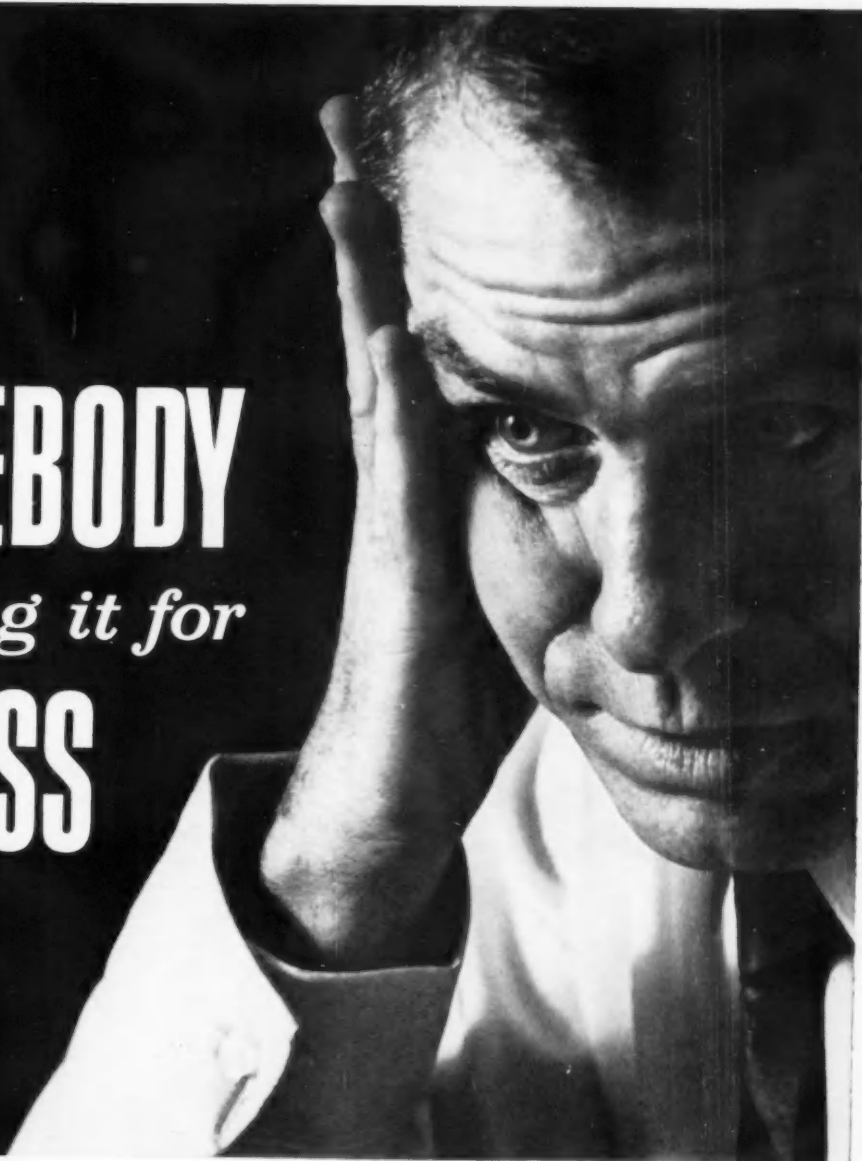
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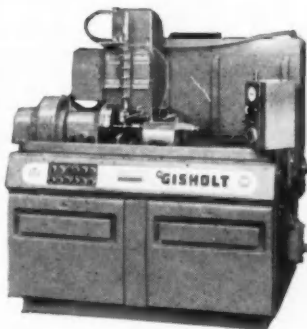
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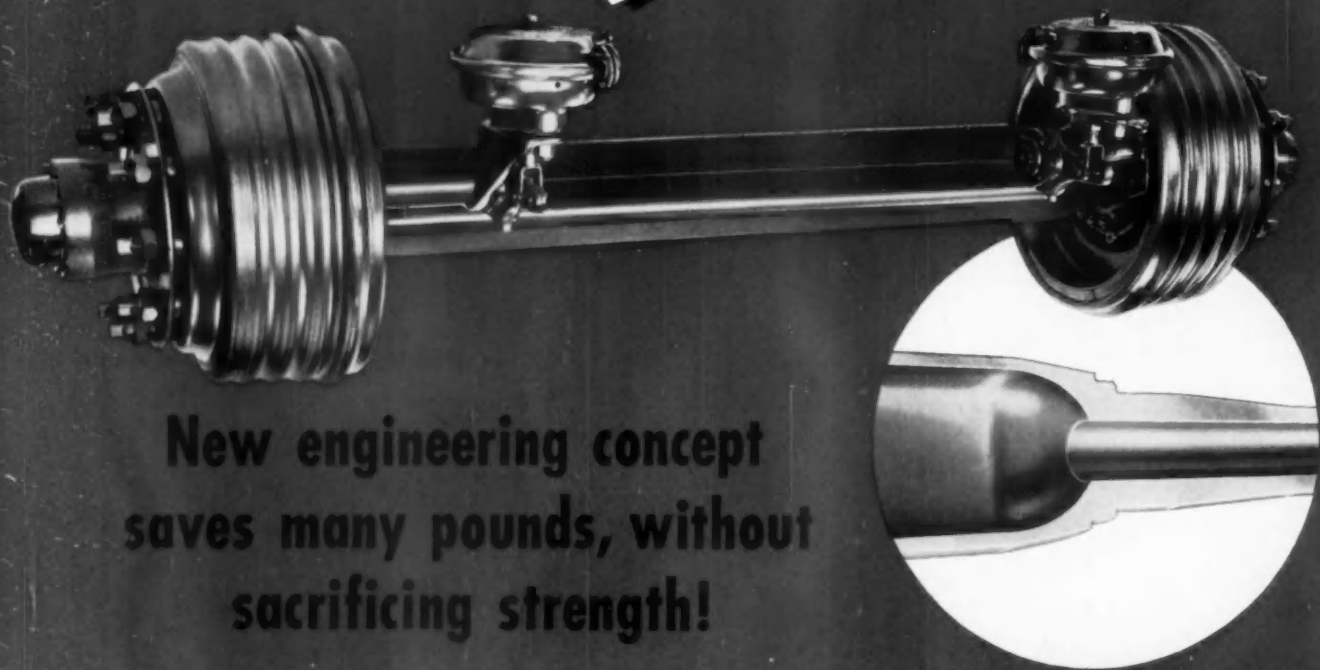
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